

Red River Waterway Project
Shreveport, LA, to Daingerfield, TX, Reach
Reevaluation Study In-Progress Review

RECREATION

PREFACE

1. In October 1988 (Fiscal Year 1989), the U.S. Army Corps of Engineers, Vicksburg District, was directed by Congress to initiate a reevaluation of the feasibility of the Shreveport, LA, to Daingerfield, TX, reach of the Red River Waterway Project. Subsequent funding was provided by Congress in Fiscal Years 1990-1993.

2. In December 1992, an in-progress review of the feasibility of extending navigation on the Shreveport to Daingerfield reach was completed. The review was a preliminary assessment of project costs, benefits, and environmental impacts. The review revealed that construction of this reach of the project was not economically feasible. The project was also found to result in significant environmental impacts for which mitigation was not considered to be practicable. The reevaluation studies were terminated as a result of the in-progress review.

3. Various documents are available so that the public can better understand the results of the reevaluation study. The documents are:

- a. In-Progress Review Documentation prepared in December 1992 for headquarters review.
- b. Environmental Summary.
- c. Regional Economic Development.
- d. Public Involvement.
- e. Recreation.
- f. Mussel Survey.
- g. Historic Watercraft Survey.
- h. Geotechnical Investigations.
- i. Geomorphic Investigations.

Copies of all these documents have been placed in the local depositories listed in the Public Involvement documentation. Copies can be obtained from the Vicksburg District for the cost of reproduction.

4. The recreation study was conducted by the U.S. Army Corps of Engineers, Fort Worth District. The purpose of this study was to identify recreation needs and demands within the project area. Recreation benefits and costs were associated with recreation features that could be incorporated into and would be compatible with a navigation project. This document was not designed to serve as a recreation master plan for the area.

TABLE OF CONTENTS

RECREATIONALTRENDS	1
DATASOURCES	1
STUDY AREA	2
RELATED RECREATIONALDEVELOPMENTS	4
C U R R E N T U S E	4
POPULATION CENTERS	5
PRESENT AND PROJECTED POPULATION	6
PER CAPITA PARTICIPATION AND TOTAL VISITOR-DAYS	6
Visits per Visitor	7
Visitors Per Capita	8
Visitor-Days	8
Consolidation of Reaches	23
GROSS FACILITY NEEDS	27
Peak Day Demand	27
Facility Standards	27
Facility Needs	29
RESOURCE INVENTORY AND ANALYSIS	29
NET FACILITY NEEDS	30
CONCEPTUAL RECREATION DEVELOPMENT OPPORTUNITIES	31
ESTIMATED ANNUAL VISITATION	36
RECREATION BENEFIT-COST ANALYSIS	36
Benefits	36
costs	41
Benefit-Cost Ratio	41

List of Tables

Table 1. County Population Centers and Approximate Distance to Project Area	2
Table 2. With-Project Projected Population for Study Area Counties	6
Table 3. Estimation of Visits per Visitor, Lake 0' The Pines	9
Table 4. Estimation of Visits per Visitor, Big Cypress Bayou	11
Table 5. Estimation of Visits per Visitor, Caddo Lake	13
Table 6. Estimation of Visitors per Capita, Lake 0' The Pines	15
Table 7. Estimation of Visitors per Capita, Big Cypress Bayou	15
Table 8. Estimation of Visitors per Capita, Caddo Lake	18
Table 9. Total Participation Rate and Visitor-Days, Lake 0' The Pines	20
Table 10. Total Participation Rate and Visitor-Days, Big Cypress Bayou	21
Table 11. Total Participation Rate and Visitor-Days, Caddo Lake	22
Table 12. Projected Population and Visitor-days, Lake 0' The Pines	24
Table 13. Projected Population and Visitor-days, Big Cypress Bayou	25
Table 14. Projected Population and Visitor-days, Caddo Lake	26
Table 15. Percent of Total Year Activity-Days Occurring on Peak Day, Lake 0' The Pines (1986-87).....	27
Table 16. Facility Requirements Criteria	28
Table 17. Existing Facilities	30
Table 18. Projected Activity-Days, Gross Facility Requirments, Existing Facilities, and Net Facility Requirements, Lake 0' The Pines	32
Table 19. Projected Activity-Days, Gross Facility Requirments, Existing Facilities, and Net Facility Requirements, Caddo Lake	33
Table 20. Computation of Economic Benefit per Visitor-Day, Lake 0' The Pines	37
Table 21. Computation of Economic Benefit per Visitor-Day, Caddo Lake	39
Table 22. Proposed Additional Facilities, Additional Activity-Days, and Economic Benefits, Lake 0' The Pines	41
Table 23. Proposed Additional Facilities, Additional Activity-Days, and Economic Benefits, Caddo Lake	42
Table 24. Proposed Additional Facilities, Additional Activity-Days, and Economic Benefits, Total Study Area	43
Table 25. Preliminary Cost Estimate for Recreation Development	44

List of Figures

Figure 1. Study Area	3
Figure 2. Observed and Predicted Visits per Visitor per Year, LakeO' ThePines	10
Figure 3. Observed and Predicted Visits per Visitor per Year, Big Cypress Bayou	12
Figure 4. Observed and Predicted Visits per Visitor per Year, CaddoLake	14
Figure 5. Observed and Predicted Visitors per Capita per Year, LakeO' ThePines	16
Figure 6. Observed and Predicted Visitors per Capita per Year, Big Cypress Bayou	17
Figure 7. Observed and Predicted Visitors per Capita per Year, CaddoLake	19
Figure 8. Second-Stage Demand Curve, Lake O' The Pines	38
Figure 9. Second-Stage Demand Curve, Caddo Lake	40

RED RIVER WATERWAY SHREVEPORT, LOUISIANA TO DAINGERFIELD, TEXAS

EVALUATION OF RECREATION NEEDS, DEMANDS, AND BENEFITS AND COSTS

RECREATIONAL TRENDS

Studies conducted by a variety of public and private groups have found that national demands for most recreational facilities are expected to increase into the next century. Increases in leisure time, physical fitness concerns, and environmental awareness are factors which will contribute to the rise in demands placed on recreational facilities. Ongoing population shifts toward the southern and western regions of the United States will create additional use pressures on existing recreation facilities in these regions. Moreover, residents of the project area report increasing use of newer types of water recreation equipment, such as airboats and jet-skis, which have the potential for more significant impact on the available resources.

DATA SOURCES

Both the projected recreation visitation to the project area, and the economic evaluation of that visitation, were analyzed with travel cost method (TCM) models. Because of time and resource constraints, only existing and readily available information was used. This was from several sources:

- The definition of the primary recreation study area, and the projection of the populations of the counties in that area, were done in the Vicksburg District office.
- Field surveys and interviews with study area residents and business proprietors were used to determine current recreation use patterns and identify perceived recreation needs and issues.
- The 1990 Texas Outdoor Recreation Plan provided net facilities needs for Regions 5 and 6 (roughly corresponding to the recreation study area), and facilities load factors, for certain specialized activities. In addition, the Texas Parks and Wildlife Department, the agency that prepared the Texas Outdoor Recreation Plan, provided raw survey data collected in 1987 for the preparation of the Plan, comprising the number of respondents and activity-days by major recreation activity and county of origin, and participation rate by planning region, for each of Lake O' The Pines, Big Cypress Bayou, and Caddo Lake.
- U.S. Census data (population, median age, and per capita income) were compiled for each of the counties identified in the Texas Parks and Wildlife Department raw survey data as a source of recreation visitation for any of the three sites.

- A Texas highway map was consulted to estimate the highway distance from each of the visitor source counties to each of the sites.

Summary data from recreation visitor surveys conducted at Lake O' The Pines in 1986 and 1987 were used to derive average party size by major recreation activity category, and the percentage of total annual visitation occurring on the peak day of the year, also by major activity category.

- Desirable peak-use load factors for various kinds of recreation facilities were obtained from *Guidelines for Understanding and Determining Optimum Recreation Carrying Capacity*, U.S. Department of the Interior, Bureau of Outdoor Recreation, January 1977.

STUDY AREA

The study area for this analysis, as previously identified in earlier analyses by Vicksburg District, comprises one county in Arkansas, two parishes in Louisiana, and sixteen counties in Texas, representing a zone of approximately 90 miles around the project alignment (Twelve Mile Bayou, Caddo Lake, Big Cypress Bayou, and Lake O' The Pines). This study area is displayed in Figure 1. About 90 percent of the total estimated existing recreation visitation to the project area originates within these counties. The counties and parishes, and their approximate one-way road distance from their principal population centers to the reaches of the study area, are shown in Table 1,

Table 1.
County Population Centers and
Approximate Distance to Project Area

country	state	principal population center	approx. 1-way travel distance (miles) to:			
			Lake O' The Pines	Big Cypress Bayou	Caddo Lake	Twelve Mile Bayou
Miller	AR	Texarkana	70	56	60	64
Bossier	LA	Bossier City	74	62	47	23
Caddo	LA	Shreveport	68	54	39	15
Bowie	TX	Texarkana	64	56	60	64
Camp	TX	Pittsburg	30	54	64	124
Cass	TX	Atlanta	39	31	35	39
Franklin	TX	Mount Vernon	66	74	84	144
Gregg	TX	Longview	35	39	43	105
Harrison	TX	Marshall	30	16	20	47
Hopkins	TX	Sulphur Springs	87	95	105	165
Marion	TX	Jefferson	25	6	16	41
Morris	TX	Daingerfield	30	38	48	108
Panola	TX	Carthage	61	51	55	117
Red River	TX	Clarksville	71	99	109	169
Rusk	TX	Henderson	65	57	61	123
Smith	TX	Tyler	71	75	79	141
Titus	TX	Mount Pleasant	50	58	68	128
Upshur	TX	Gilmer	30	49	59	119
Wood	TX	Quitman	57	80	so	150

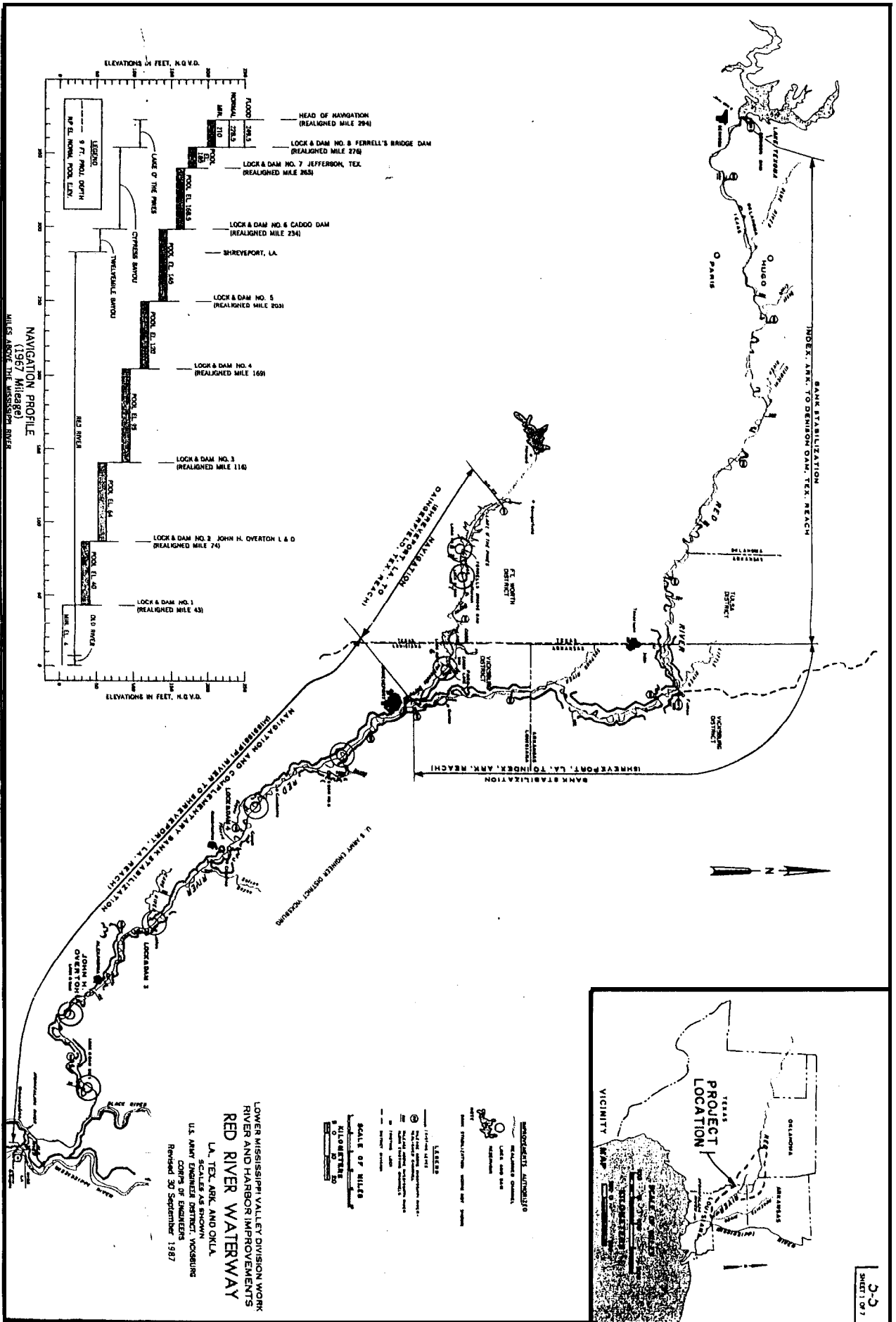


Figure 1

RELATED RECREATIONAL DEVELOPMENTS

Related recreational developments are those within the study area that provide recreational opportunities that may influence future recreation use along the Red River Waterway between Shreveport and Daingerfield. Caddo Lake State Park, managed by the Texas Parks and Wildlife Department, is among the most significant recreational development in the study area. Lake O' The Pines, managed by the U. S. Army Corps of Engineers, also offers well-developed recreational opportunities. Use patterns associated with these developments can be used as an indicator of future utilization in the project area.

CURRENT USE

Current use patterns of the study area were identified through direct observation and personal communications with representatives of the States of Texas and Louisiana, Marion County Chamber of Commerce, local business owners, and interested citizens.

Twelve Mile Bayou runs from Shreveport to Caddo Lake and constitutes the lowest portion of the project area. Water recreation is virtually nonexistent on Twelve Mile Bayou. There are no formal boat ramps on the bayou. Site surveys revealed evidence of bank fishing at overpasses, as well as bank fishing below the spillway at Caddo Lake. The lack of water recreation on Twelve Mile Bayou can be attributed to extremely limited access to the bayou, as well as an abundance of recreational facilities in the region.

Caddo Lake, which straddles the Texas-Louisiana border, attracts visitors from greater distances than most recreational lakes. This is largely due to the lake's unique beauty and the wide variety of recreational opportunities available. Water recreation on the open, eastern portion of the lake (the Louisiana side) is most consistent with conventional lake recreation. This portion of the lake is used primarily for fishing, swimming, boating, and picnicking. Boating on the western end of the lake is limited to narrow boat lanes due to the presence of scattered trees and tree stumps, shallow waters, and oil rigs on the lake. These factors limit the extent of water recreation for safety reasons.

On the Louisiana side of the lake, there are approximately 13 boat ramps with a total of 21 boat lanes in service. There are approximately 46 picnic sites and 23 campsites (10 R.V., 8 tent and 5 cabins) serving the Louisiana side of the lake. In addition, Earl Williamson Park in Oil City maintains a public swimming beach on Caddo.

The western portion (the Texas side) of Caddo Lake is a swamp-like area, with boat lanes and lily ponds dividing dense stands of cypress trees draped with Spanish moss. This area is used primarily for fishing, hunting, camping, nature study, and canoeing. Pleasure boating and water skiing also take place on this part of the lake, but are limited to cleared areas. Once again, safety is a factor which limits visitor freedom on the lake. However, there are a number of guide services available to facilitate visitor access to all that Caddo Lake offers.

The Texas side of Caddo Lake is served by approximately 5 boat ramps with a total of 7 lanes. In addition, there are approximately 84 picnic tables, 79 of which are located at Caddo Lake State Park. There are more than 93 campsites (65 located at the State Park). The campsites include 16 R.V. sites, 57 tent sites, and 24 cabins. Caddo Lake State Park, at the westernmost end of the lake, is the largest recreational facility on the lake.

The next section of the study area is Big Cypress Bayou which extends from Ferrell's Bridge Dam at Lake O' The Pines east through Jefferson, Texas to Caddo Lake. The bayou can be accessed from a public boat ramp in Jefferson. The primary recreational activities for this portion of the study area are canoeing, boating, and fishing, with limited water skiing.

Activities on Big Cypress Bayou are centered around Jefferson, with the exception of bank fishing below the dam at Lake O' The Pines. There are a number of businesses in Jefferson offering water recreation services. Several businesses offer boat tours and guide service. At least two businesses offer canoe rentals.

Lake O' The Pines is a Corps lake with numerous facilities and businesses supporting recreation. All types of water recreation can be experienced at the lake including fishing, swimming, camping, picnicking, boating, and water skiing. There are approximately 63 boat ramps providing access to the lake, 198 picnic sites (7 of which are group facilities), and 461 campsites (2 of which are group facilities).

In general, the business owners in the study area who were interviewed indicate that, despite seasonal fluctuations in activity, business is very busy and seems to be in a period of growth. There was an overwhelming consensus among those interviewed that visitors are primarily from the Dallas-Fort Worth area, with additional visitors from Houston, Shreveport, Longview, and Tyler. However, this conclusion is not supported by the limited visitor survey data available (see below). One possible explanation is that recreation-related businesses (guides, tours, campgrounds, etc.) are patronized primarily by visitors from distant locations, with the (more numerous) locally-originating visitors simply recreating "on their own". The available data is insufficient to resolve this question.

POPULATION CENTERS

The largest city in the study area is Shreveport, Louisiana, with a 1990 population of 198,525. Smaller, but closer to the project area, are the neighboring cities of Longview, Texas, and Marshall, Texas, with 1990 populations of 104,948 and 57,483 respectively. The city of Texarkana, in Texas and Arkansas, has a total population roughly equal to that of Marshall, but with a much smaller influence on the study area because of its greater distance, and recreational competition from nearby Wright Patman Lake. Similarly, Tyler, Texas, with a 1990 population of 75,450, is limited in its influence by distance.

PRESENT AND PROJECTED POPULATION

As shown in Table 2 below, the 1990 population of the counties in the study area was just over 1,060,000. Caddo Parish, Louisiana, accounted for about one-fourth of the total, with Smith and Gregg Counties, Texas, accounting for another one-fourth. The study area population (inclusive of the economic and demographic effects of the proposed project) is projected to increase to 1,546,000 by 2050, an overall average annual growth rate of 0.6 percent per year. Nearly half of the growth in population, however, is projected to occur by 2001, the first year of project operation. Morris, Panola, Red River, and Smith Counties, Texas, would grow the most rapidly between 1990 and 2001; Morris, Gregg, Smith, and Red River Counties, Texas, would grow the most rapidly overall between 1990 and 2050. (Not coincidentally, Morris County contains the city of Daingerfield, which is the primary locus of the economic navigation benefits of the project.)

Table 2.
With-Project Projected Population
for Study Area Counties

county	state	1990	2001	2010	2020	2030	2040	2050
Miller	AR	39,913	44,000	47,000	50,000	52,000	53,000	54,000
Bossier	LA	91,106	104,000	111,000	116,000	122,000	125,000	128,000
Caddo	LA	269,688	307,000	328,000	344,000	360,000	369,000	378,000
Bowie	TX	81,665	88,000	95,000	99,000	104,000	106,000	109,000
Camp	TX	9,904	12,000	13,000	14,000	14,000	15,000	15,000
Cass	TX	29,982	36,000	38,000	41,000	42,000	44,000	45,000
Franklin	TX	7,802	8,000	10,000	10,000	11,000	11,000	11,000
Gregg	TX	104,948	129,000	139,000	147,000	154,000	158,000	163,000
Harrison	TX	57,483	68,000	74,000	78,000	82,000	84,000	87,000
Hopkins	TX	28,833	35,000	38,000	40,000	41,000	43,000	44,000
Marion	TX	9,984	11,000	12,000	13,000	13,000	14,000	14,000
Morris	TX	13,200	17,000	18,000	19,000	20,000	20,000	21,000
Panola	TX	22,035	28,000	28,000	30,000	31,000	32,000	33,000
Red River	TX	14,317	18,000	19,000	20,000	21,000	22,000	22,000
Rusk	TX	43,375	50,000	54,000	57,000	59,000	61,000	63,000
Smith	TX	151,309	187,000	201,000	212,000	222,000	229,000	235,000
Titus	TX	24,009	27,000	29,000	31,000	32,000	33,000	34,000
Upshur	TX	31,370	38,000	41,000	43,000	45,000	46,000	47,000
Wood	TX	29,380	34,000	37,000	39,000	41,000	42,000	43,000
Total Study Area		1,060,302	1,241,000	1,332,000	1,403,000	1,466,000	1,507,000	1,546,000

PER CAPITA PARTICIPATION AND TOTAL VISITOR-DAYS

Both the projected recreation visitation to the project area, and the economic value of that visitation, were analyzed with travel cost method (TCM) models. Because of time and resource constraints, only existing and readily available information was used. However, the only existing, available data sufficiently detailed for present analytical purposes were for visitors originating within the state of Texas, and recreation locations within the state of Texas (Lake O' The Pines, Big Cypress Bayou, and Caddo Lake). No data was available for the Twelve Mile Bayou portion of the project area. The published data in the State Comprehensive Outdoor Recreation Plans (SCORPs) for Louisiana and Arkansas, unlike the Texas Outdoor

Recreation Plans (SCORPs) for Louisiana and Arkansas, unlike the Texas Outdoor Recreation Plan, are so highly aggregated as to be of limited use for an analysis like this, and the respective state agencies, unlike the Texas Parks and Wildlife Department, were unable to provide more specific information. It was therefore necessary to apply the visitation and economic value relationships modeled from Texas data to visitors originating in the Louisiana and Arkansas counties in the study area. Visitation originating from outside the Texas counties included in the TPWD raw survey data, or from the remainder of the United States, was generally ignored.

These simplifications are not unreasonable for this level of study effort, and are judged not to seriously affect the findings of this analysis. However, any additional recreation studies for this project should include more specific and detailed data collection, including recreation visitor surveys at all relevant sites.

The Texas Parks and Wildlife Department (TPWD), the agency that prepared the Texas Outdoor Recreation Plan (TORP), provided the Fort Worth district office with raw survey data collected in 1987 for the 1990 TORP, comprising, for each of Lake O' The Pines, Big Cypress Bayou, and Caddo Lake, (1) the number of respondents and total activity-days for the surveyed year by county of origin and major recreation activity, and (2) the "participation rate" – meaning the proportion of the population visiting one or more times in the survey year – by TPWD multi-county region. Neither set of data directly showed the number of visitor-days per capita as a function of distance traveled, which is the basis for a travel cost model, so an indirect approach was necessary: estimating per capita visitor-days by county as the product of separately estimated relationships between the number of annual *visits per visitor* for each county and travel distance, and between the proportion of the population of each county visiting one or more times in the survey year (that is, *visitors per capita*) and travel distance. (For each reach, statistical regressions were performed relating visitation by county of origin to county per capita income and median age, as well as travel distance. The former two variables were found not to be statistically significant, however, and visitation was found to be adequately explained by distance alone.)

Visits per Visitor.

The data on the number of respondents and total activity-days for the surveyed year by county of origin and major recreation activity were used to estimate the number of visits per visitor per year, by county of origin. Since visitors often engage in more than one activity per visit, to avoid double-counting (and in accordance with TPWD's own methodology) it was assumed that the activity showing the maximum number of activity-days, divided by the number of respondents, reflected the number of visits per visitor from each county. For visitors from at least 75 miles away, it was further assumed that they would be camping, and the maximum number of activity-days was therefore divided by the number of activity-days of camping per respondent (to account for multiple activity-days occurring during a multi-day camping visit). The data did not permit the latter adjustment to be made county-by-county, and there was no evident statistical relationship between travel distance and the number of activity-days of camping per respondent, so the average number of activity-days of camping per respondent over

all counties was used for each reach. The resulting inferred numbers of visits per visitor were regressed against one-way travel distance, and for each reach the best statistical fit was found to be of the form

$$Y = a + bX^{-n}$$

where Y is the number of visits per visitor, X is the one-way travel distance, a and b are regression parameters, and n was determined by trial and error to maximize R² for the statistical relationship (subject to the additional constraint that the closest county not have an unreasonably high number of visits per visitor). Tables 3, 4, and 5 display the TPWD raw data for visits per visitor and the regression parameters that yielded the best statistical fit, for Lake O' The Pines, Big Cypress Bayou, and Caddo Lake. Figures 2, 3, and 4 graphically display the observed data points and the fitted curve for each reach.

Visitors Per Capita.

A weighted-average travel distance from each TPWD region to each reach was calculated by summing the product of the distance from each county for which visitation was reported by its population, and dividing by the sum of the county populations in that region. The surveyed values of visitors per capita were regressed against one-way travel distance, and for each reach the best statistical fit was again found to be of the form

$$Y = a + bX^{-n}$$

where Y is the proportion of population visiting, X is the one-way travel distance, a and b are regression parameters, and n was determined by trial and error to maximize R² for the statistical relationship (subject to the additional constraint that the closest county not have more than 100 percent of its population visiting). Tables 6, 7, and 8 display the TPWD raw data for proportion of population visiting at least once and the regression parameters that yielded the best statistical fit, for Lake O' The Pines, Big Cypress Bayou, and Caddo Lake. Figures 5, 6, and 7 graphically display the observed data points and the fitted curve for each reach.

Visitor-Days.

For each county reporting visitation in the TPWD data, the two modeled estimates (visitor-days per visitor, and visitors per capita) based on its travel distance were multiplied together to produce a total participation rate. This in turn was multiplied by county population to produce total visitor-days from each county. Tables 9, 10, and 11 show this calculation for each reach, with counties listed in increasing order of travel distance. The study area accounts for about 96 percent of the recreation visitor-days for Lake O' The Pines, compared to about 87 percent of the visitor-days for Caddo Lake. This implies that Caddo Lake is a stronger attractor to more distant visitors than Lake O' The Pines, arguably because Caddo Lake is much more distinctive (if not unique) in terms of its physical, aesthetic, and recreational attributes.

Table 3.
Estimation of Visits per Visitor,
Lake O' The Pines

county	TPWD region	approx. 1-way travel	number of respondents	RAW DATA: respondents and activity-days for Lake O' The Pines							implied annual visits per visitor predicted	
		distance (miles)		camping	picnicking	hiking	nature study	swimming	fishing	boating		
Marion	6	26	12	23	63	0	0	340	222	260	26.333	16.406
Camp	6	30	1	0	6	0	0	9	0	0	9.000	12.693
Harrison	6	30	19	14	101	0	0	176	36	111	0.211	12.693
Morris	5	30	4	3	0	0	0	9	47	0	11.760	12.693
Upshur	6	30	14	37	6	0	0	96	149	16	10.671	12.693
Gregg	6	36	31	72	61	20	66	231	164	106	7.462	9.667
Case	5	39	11	76	6	0	0	7	110	23	10.000	7.774
Titu	5	60	0	0	0	0	0	0	0	0	0.000	4.670
Wood	6	67	1	0	0	0	0	0	4	0	4.000	3.629
Panola	6	61	1	0	6	0	0	0	0	2	6.000	3.369
Bowie	6	64	1	0	3	0	0	3	0	2	3.000	3.111
Rusk	6	66	2	0	0	0	0	2	0	1	1.000	3.027
Franklin	6	66	0	0	0	0	0	0	0	0	0.000	2.947
Red River	6	71	1	3	0	0	0	0	0	0	3.000	2.696
Smith	6	71	0	0	0	0	0	0	0	0	0.000	2.696
Hopkins	6	67	0	0	0	0	0	0	0	0	0.000	1.647
Hunt	4	98	2	6	0	0	0	0	6	1	1.699	1.632
Nacogdoches	14	106	1	2	0	0	0	0	0	0	0.649	1.361
Henderson	6	107	0	0	0	0	0	0	0	0	0.000	1.342
San Augustine	14	107	0	0	0	0	0	0	0	0	0.000	1.342
Fannin	22	116	2	6	2	0	0	0	0	0	1.062	1.210
Anderson	6	119	1	0	0	0	0	0	2	2	0.649	1.163
Angeline	14	122	1	0	0	0	0	1	0	1	0.426	1.116
Grayson	22	143	1	12	0	0	0	12	12	12	6.096	0.006
Houston	14	166	0	0	0	0	0	0	0	0	0.000	0.626
Collin	4	166	1	3	0	0	0	3	0	0	1.274	0.620
Dallas	4	160	3	6	0	0	0	9	6	7	1.274	0.797
Tarrant	4	190	1	0	0	0	0	0	0	1	0.426	0.669
Brazos	13	212	2	3	3	0	0	3	0	23	4.664	0.606
Jefferson	16	229	1	0	2	0	2	0	0	0	0.649	0.672
Hood	4	231	0	0	0	0	0	0	0	0	0.000	0.666
Harris	16	241	0	0	0	0	0	0	0	0	0.000	0.661
Grimes	13	246	0	0	0	0	0	0	0	0	0.000	0.640
Archer	3	281	2	10	0	0	0	0	1	1	2.123	0.600
Washington	13	262	0	0	0	0	0	0	0	0	0.000	0.499
Brazoria	16	291	0	0	0	0	0	0	0	0	0.000	0.490
Travis	12	291	0	0	0	0	0	0	0	0	0.000	0.490
Burnet	12	297	0	0	0	0	0	0	0	0	0.000	0.466
Lavaca	17	363	1	0	0	0	0	1	0	0	0.426	0.447
Gray	1	466	1	10	0	0	0	0	10	0	4.247	0.411
Lubbock	2	462	1	2	0	0	0	0	0	0	0.849	0.406
Midland	9	467	1	1	0	0	0	0	4	4	1.699	0.404
Ector	9	606	0	0	0	0	0	0	0	0	0.000	0.401
Potter	1	617	1	0	0	0	0	0	6	1	2.123	0.399
Randall	1	617	1	1	0	0	0	0	6	0	3.397	0.399
Crane	9	639	1	0	0	0	0	1	0	0	0.426	0.396
Moore	1	666	1	0	3	0	0	3	3	0	1.274	0.392
TOTALS			124	292	261	20	66	694	779	664		
% of total activity-days				10.19%	6.76%	0.70%	2.37%	31.17%	27.16%	19.67%		

• $Y = 0.3666 + 11292 \cdot X^{2.0}$
 $R^2 = 0.76$

Figure 2.
Observed and Predicted
Visits per Visitor per Year,
Lake O' The Pines

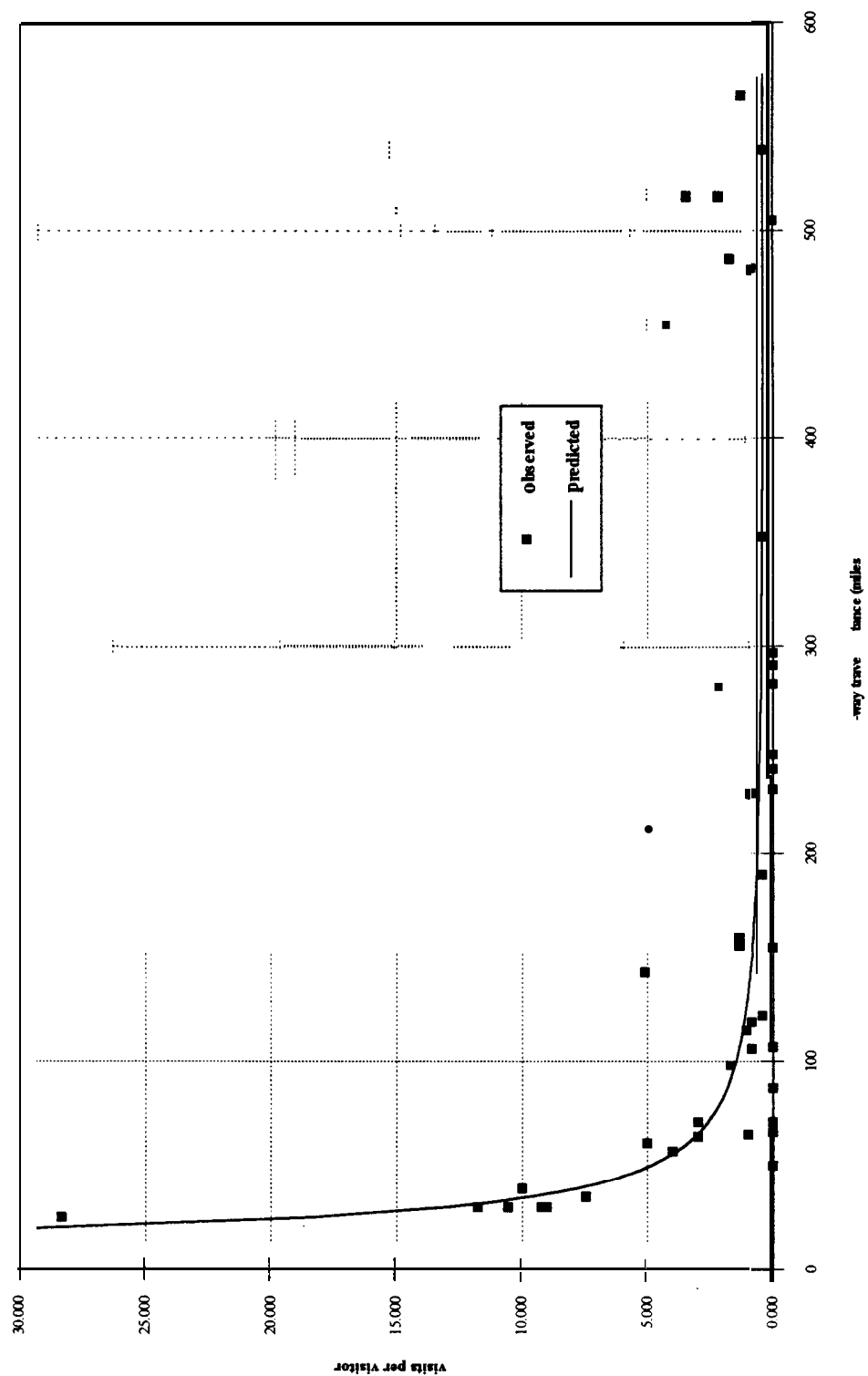


Table 4.
Estimation of Visits per Visitor,
Big Cypress Bayou

county	TPWD region	approx. 1-way travel distance (miles)	number of respondents	RAW DATA: respondents and activity-days for Lake O' The Pines							implied annual visits per visitor predicted .	
				camping	picnicking	hiking	nature study	swimming	fishing	boating	visitor	predicted .
Marion	S	6	3	0	0	0	0	6	14	4	4.667	4.363
Harrison	6	64	0	0	0	0	0	0	0	0	0.000	0.162
Columbia	5	16	0	0	0	0	0	0	0	0	0.000	1.007
Gregg	6	36	1	0	0	0	1	0	0	1	1.000	0.276
Morris	6	49	0	0	0	0	0	0	0	0	0.000	0.188
Panola	6	39	0	0	0	0	0	0	0	0	0.000	0.284
Upshur	6	31	0	0	0	0	0	0	0	0	0.000	0.373
Bowie	6	68	0	0	0	0	0	0	0	0	0.000	0.146
Rusk	6	80	0	0	0	0	0	0	0	0	0.000	0.090
Camp	6	61	0	0	0	0	0	0	0	0	0.000	0.177
Titus	6	66	0	0	0	0	0	0	0	0	0.000	0.164
Smith	6	67	0	0	0	0	0	0	0	0	0.000	0.160
Franklin	6	74	0	0	0	0	0	0	0	0	0.000	0.101
Wood	6	99	0	0	0	0	0	0	0	0	0.000	0.066
San Augustine	14	76	0	0	0	0	0	0	0	0	0.000	0.099
Nacogdoches	14	96	0	0	0	0	0	0	0	0	0.000	0.070
Hopkins	6	126	0	0	0	0	0	0	0	0	0.000	0.048
Red River	6	100	0	0	0	0	0	0	0	0	0.000	0.084
Henderson	6	111	0	0	0	0	0	0	0	0	0.000	0.066
Angelina	14	97	0	0	0	0	0	0	0	0	0.000	0.067
Anderson	6	143	0	0	0	0	0	0	0	0	0.000	0.038
Hunt	4	121	0	0	0	0	0	0	0	0	0.000	0.048
Fannin	22	119	0	0	0	0	0	0	0	0	0.000	0.060
Houston	14	171	0	0	0	0	0	0	0	0	0.000	0.029
Dallas	4	162	0	0	0	0	0	0	0	0	0.000	0.034
Collin	4	159	0	0	0	0	0	0	0	0	0.000	0.032
Grayson	22	184	0	0	0	0	0	0	0	0	0.000	0.031
Tarrant	4	194	0	0	0	0	0	0	0	0	0.000	0.024
Jefferson	16	226	0	0	0	0	0	0	0	0	0.000	0.019
Brazos	13	218	0	0	0	0	0	0	0	0	0.000	0.020
Hood	4	236	0	0	0	0	0	0	0	0	0.000	0.016
Grimes	13	243	0	0	0	0	0	0	0	0	0.000	0.017
Harris	16	236	1	0	0	0	0	0	1	0	0.313	0.018
Washington	13	309	0	0	0	0	0	0	0	0	0.000	0.012
Travis	12	269	0	0	0	0	0	0	0	0	0.000	0.016
Burnet	12	306	0	0	0	0	0	0	0	0	0.000	0.012
Brazoria	16	296	0	0	0	0	0	0	0	0	0.000	0.013
Archer	3	301	0	0	0	0	0	0	0	0	0.000	0.012
Lavaca	17	366	0	0	0	0	0	0	0	0	0.000	0.010
Lubbock	2	494	0	0	0	0	0	0	0	0	0.000	0.006
Midland	9	466	0	0	0	0	0	0	0	0	0.000	0.006
Gray	1	491	0	0	0	0	0	0	0	0	0.000	0.006
Ector	9	611	0	0	0	0	0	0	0	0	0.000	0.006
Potter	1	621	0	0	0	0	0	0	0	0	0.000	0.006
Randall	1	621	0	0	0	0	0	0	0	0	0.000	0.006
Crane	9	643	0	0	0	0	0	0	0	0	0.000	0.006
Moore	1	670	0	0	0	0	0	0	0	0	0.000	0.006
TOTALS			6	0	0	0	1	6	16	6		
% of total activity-days				0.00%	0.00%	0.00%	3.86%	19.23%	67.89%	19.23%		

. Y = 64.41993 * X^{-1.6}
R² = 0.90

Figure 3.
Observed and Predicted
Visits per Visitor per Year;
Big Cypress Bayou

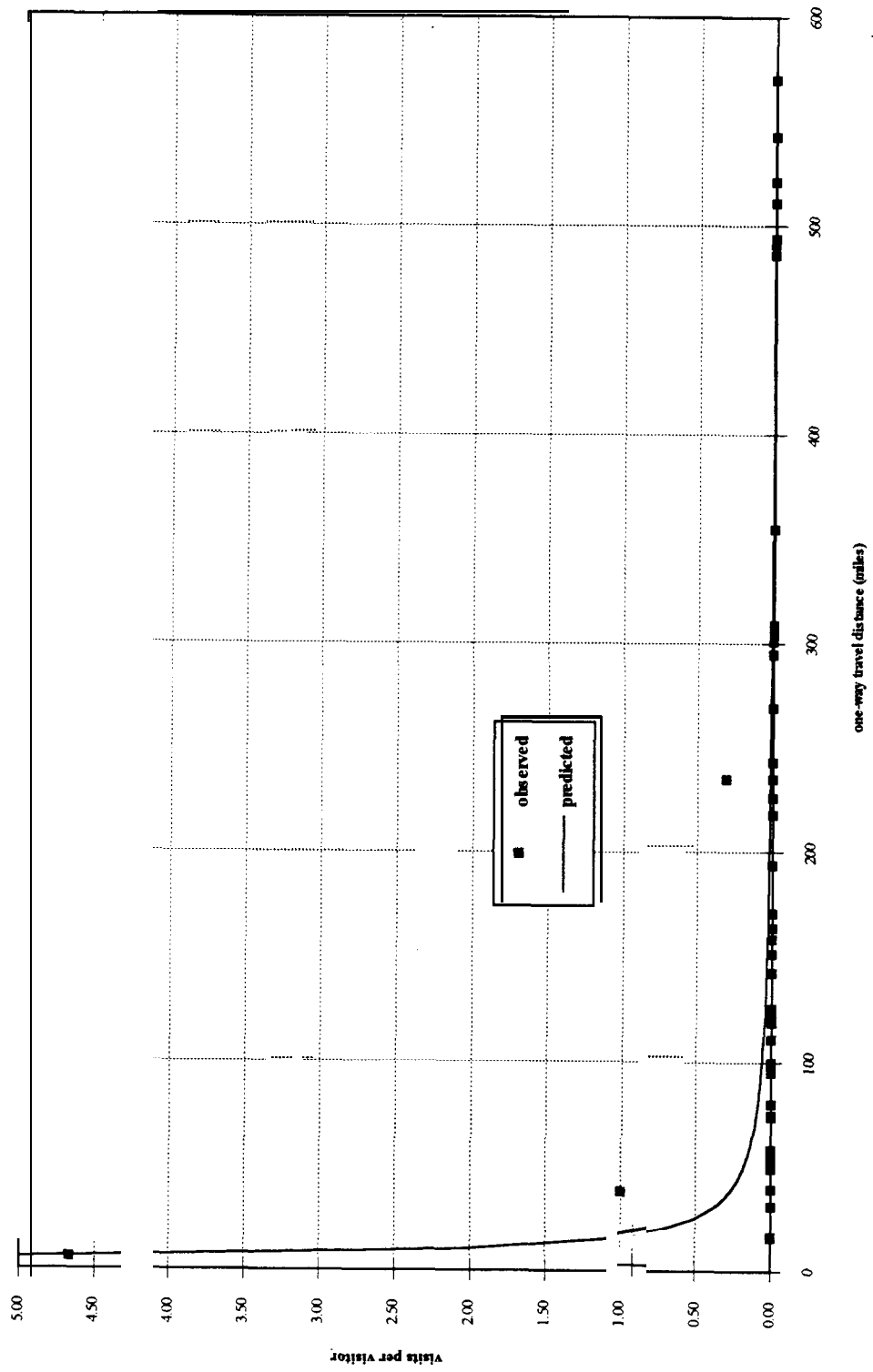


Table 5.
Estimation of Visits per Visitor,
Caddo Lake

county	T P W D region	approx. 1-way travel distance (miles)	number of respondents	RAW DATA: respondents and activity-days for Lake O' The Pines							implied annual visits per visitor predicted	
				camping	picnicking	hiking	nature study	swimming	fishing	boating		
Mario	6	16	6	6	3	0	0	2	46	9	9,000	8.849
Harrison	6	20	12	4	6	1	0	26	29	60	4,167	7.367
Cass	6	36	9	12	2	0	0	32	69	19	9,889	4.766
Gregg	6	43	6	2	6	2	2	0	106	16	13,260	4.113
Morris	6	48	1	0	0	0	0	0	6	6	6,000	3.602
Panola	6	66	1	0	2	0	0	0	0	0	2,000	3.467
Upshur	6	59	2	0	0	0	0	2	0	1	1,000	3.286
Bowie	6	60	1	1	0	1	1	0	0	1	1,000	3.266
Rusk	6	61	1	0	0	0	0	0	1	1	1,000	3.222
Camp	6	64	1	1	0	0	0	0	0	0	1,000	3.120
Titus	6	66	1	0	0	3	3	0	0	0	3,000	2.996
Smith	6	79	1	7	0	0	0	0	0	0	3,343	2.722
Franklin	6	64	0	0	0	0	0	0	0	0	0,000	2.619
Wood	6	50	0	0	0	0	0	0	0	0	0,000	2.610
San Augustine	14	101	1	6	0	0	0	0	6	6	2,666	2.343
Nacogdoches	14	104	0	0	0	0	0	0	0	0	0,000	2.303
Hopkins	6	106	0	0	0	0	0	0	0	0	0,000	2.290
Red River	6	109	0	0	0	0	0	0	0	0	0,000	2.241
Henderson	6	116	1	3	0	0	0	0	0	0	1,433	2.174
Angelina	14	123	1	6	0	0	0	0	0	6	2,366	2.094
Anderson	6	126	0	0	0	0	0	0	0	0	0,000	2.076
Hunt	4	136	0	0	0	0	0	0	0	0	0,000	1.983
Fannin	22	163	0	0	0	0	0	0	0	0	0,000	1.666
Houston	14	166	1	3	0	0	0	0	0	0	1,433	1.647
Dallas	4	166	4	66	0	0	3	23	3	14	6,667	1.760
Collin	4	169	0	0	0	0	0	0	0	0	0,000	1.776
Grayson	22	161	0	0	0	0	0	0	0	0	0,000	1.716
Tarrant	4	196	1	3	0	3	0	0	0	1	1,433	1.647
Jefferson	16	222	1	10	7	0	0	0	0	0	4,776	1.666
Brazos	13	230	1	0	0	0	0	26	26	20	11,940	1.642
Hood	4	239	1	2	0	0	0	0	0	0	0,966	1.617
Grimes	13	239	1	10	0	8	0	0	0	1	4,776	1.617
Harris	16	247	1	0	0	0	0	0	4	0	1,910	1.497
Washington	13	273	1	0	0	0	1	0	0	0	0,476	1.436
Travis	12	299	2	4	0	0	0	0	0	0	0,855	1.366
Burnet	12	306	1	0	0	0	0	0	4	0	1,010	1.376
Brazoria	16	308	1	0	4	0	0	0	20	0	9,662	1.372
Archer	3	313	0	0	0	0	0	0	0	0	0,000	1.366
Leake	17	359	0	0	0	0	0	0	0	0	0,000	1.301
Lubbock	2	490	0	0	0	0	0	0	0	0	0,000	1.162
Midland	9	466	1	1	0	0	0	1	0	1	0,476	1.178
Gray	1	496	0	0	0	0	0	0	0	0	0,000	1.176
Ector	9	616	1	0	0	0	0	0	2	0	0,966	1.166
Potter	1	626	0	0	0	0	0	0	0	0	0,000	1.169
Randall	1	626	0	0	0	0	0	0	0	0	0,000	1.159
Crane	9	647	0	0	0	0	0	0	0	0	0,000	1.147
Moore	1	674	0	0	0	0	0	0	0	0	0,000	1.132
TOTALS			64	134	34	18	10	111	340	160		
% of total activity-days				16.61%	4.27%	2.26%	1.26%	13.93%	42.66%	16.62%		

• $Y = 0.612 + 97.46913 \cdot X^{0.9}$
 $R^2 = 0.20$

Figure 4.
Observed and Predicted
Visits per Visitor per Year,
Caddo Lake

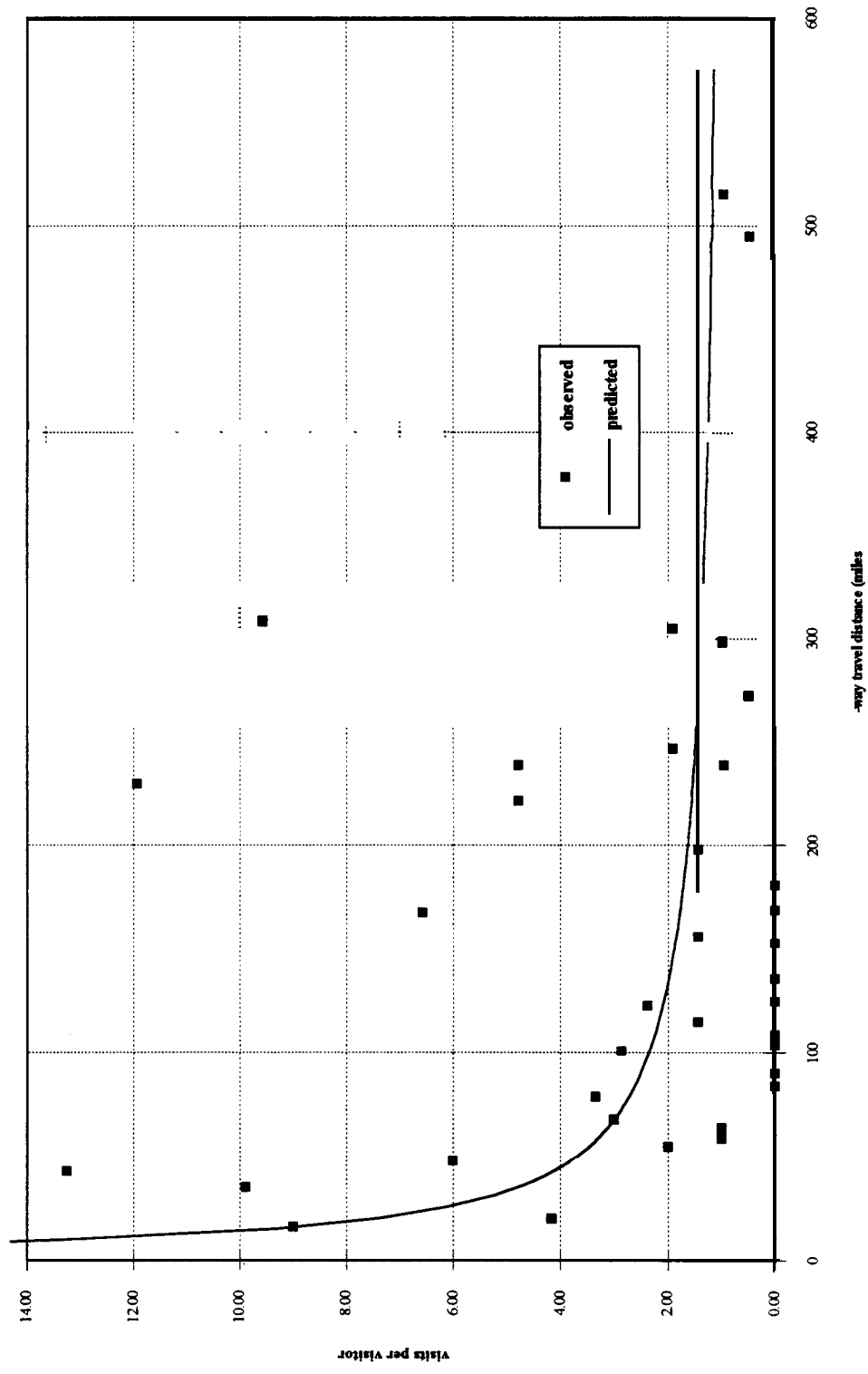


Table 6.
Estimation of Visitors per Capita,
Lake O' The Pines

TPWD region	1990 population	approx. 1-way travel distance (miles)	<i>visitors par capita:</i>	
			observed	predicted .
		25		0.5658
		40		0.2210
6	566,355	63	0.160853	0.0903
5	199,808	60	0.040964	0.0975
14	154,011	120	0.004386	0.0245
22	119,825	137	0.006061	0.0188
4	3,140,204	171	0.007439	0.0122
13	166,844	227	0.005277	0.0069
15	239,397	229	0.003690	0.0067
16	3,009,906	244	0.000000	0.0059
3	7,973	281	0.005115	0.0045
12	599,084	291	0.000000	0.0042
17	18,690	353	0.002475	0.0028
2	222,636	482	0.002045	0.0015
9	230,197	497	0.005450	0.0014
	229,379	514	0.007477	0.0013

• $Y = 353.6134 \cdot X^{-2.0}$
 $R^2 = 0.62$

Table 7.
Estimation of Visitors per Capita,
Big Cypress Bayou

TPWD region	1990 population	approx. 1-way travel distance (miles)	<i>visitors par capita:</i>	
			observed	predicted .
		25		0.0272
		40		0.0094
6	566,355	65	0.007752	0.0032
5	199,808	61	0.000000	0.0037
14	154,011	116	0.000000	0.0009
22	119,825	165	0.000000	0.0004
4	3,140,204	175	0.000000	0.0003
13	166,844	234	0.000000	0.0002
15	239,397	218	0.000000	0.0002
16	3,009,906	247	0.001513	0.0002
3	7,973	309	0.000000	0.0001
12	599,084	295	0.000000	0.0001
17	18,690	355	0.000000	0.0001
2	222,636	486	0.000000	0.0000
9	230,197	502	0.000000	0.0000
1	229,379	522	0.000000	0.0000

• $Y = 37.98727 \cdot X^{-2.25}$
 $R^2 = 0.33$

Figure 5.
Observed and Predicted
Visitors per Capita per Year,
Lake O' The Pines

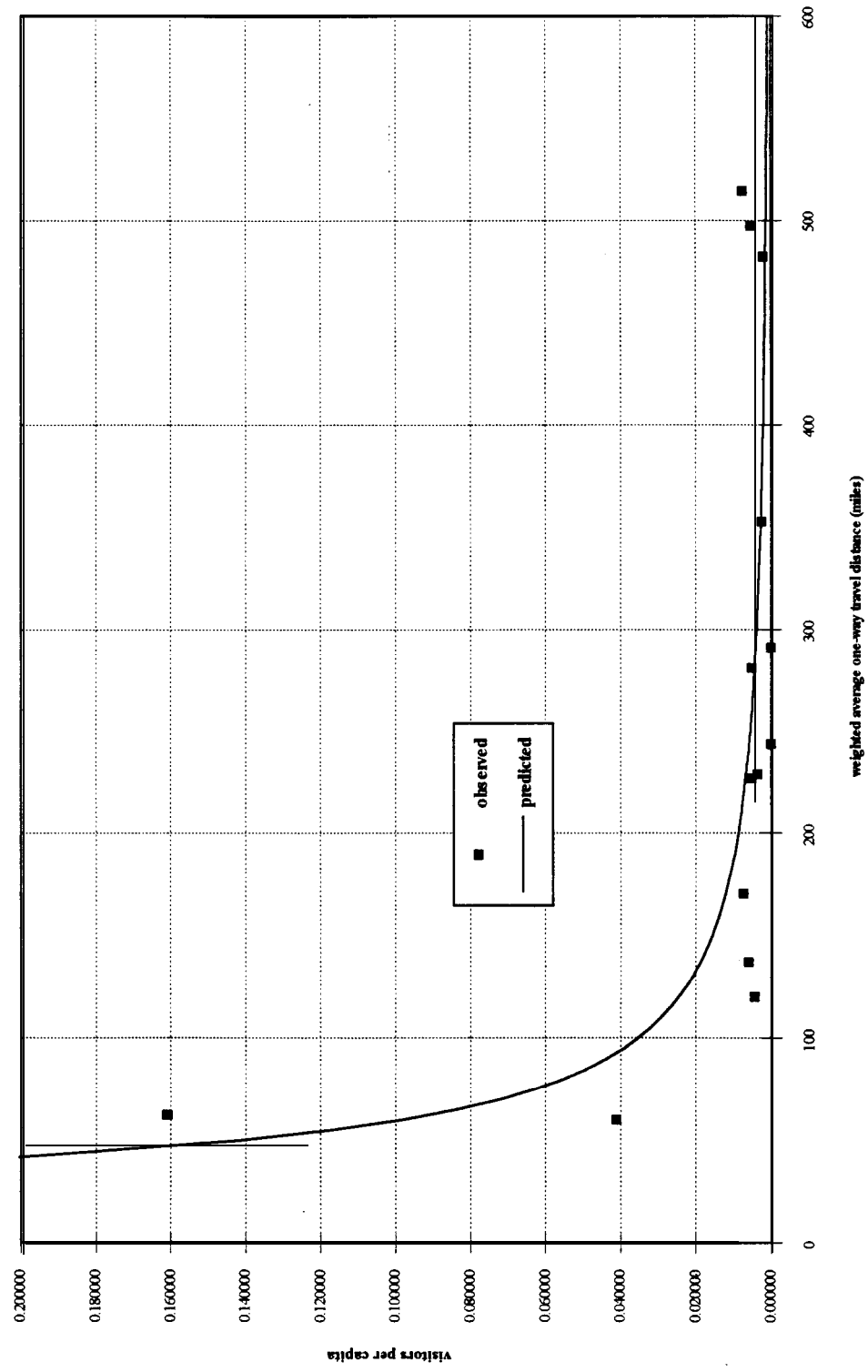


Figure 6.
Observed and Predicted
Visitors per Capita per Year;
Big Cypress Bayou

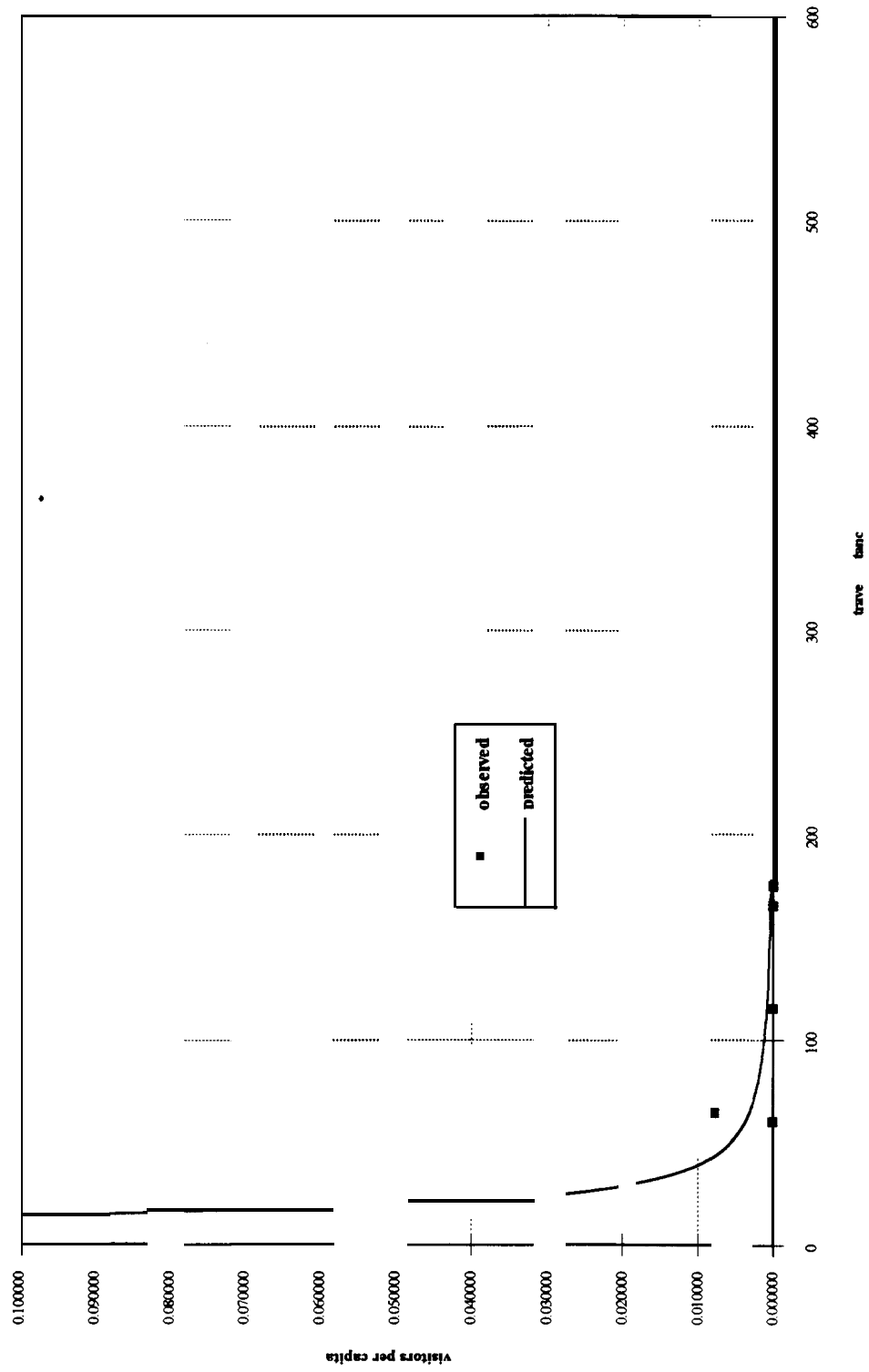


Table 8.
Estimation of Visitors per Capita,
Caddo Lake

TPWD region	1990 population	approx. l - w a y travel distance (miles)	<i>visitors per capita:</i>	
			observed	predicted .
		25		0.2607
		40		0.1119
6	566,355	70	0.062016	0.0411
5	199,808	67	0.028916	0.0438
14	154,011	120	0.006579	0.0156
22	119,825	175	0.000000	0.0078
4	3,140,204	179	0.006376	0.0075
13	166,844	238	0.0079 16	0.0045
15	239,397	222	0.003690	0.0051
16	3,009,906	251	0.003026	0.0041
3	7,973	313	0.000000	0.0028
12	599,084	299	0.005435	0.0030
17	18,690	359	0.000000	0.0022
2	222,636	490	0.000000	0.0012
9	230,197	506	0.005450	0.0012
	229,379	526	0.000000	0.0011

*Y= 85.57616 *X^{-1.8}
R² = 0.77

Figure 7.
Observed and Predicted
Visitors per Capita per Year;
Caddo Lake

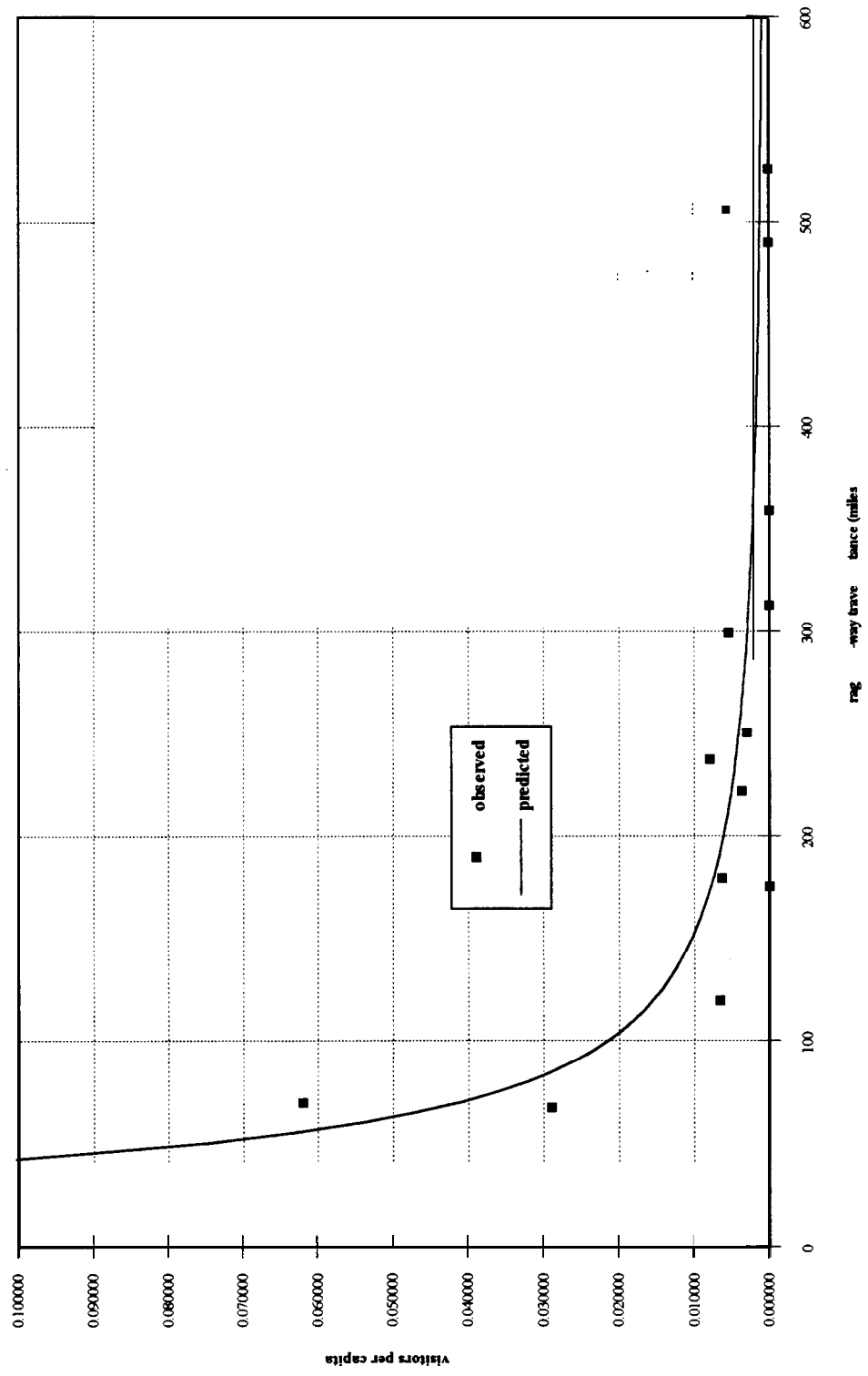


Table 9.
Total Participation Rate and Visitor-Days,
Lake O' The Pines

county		principal population center	1990 population	approx. 1-way travel distance (miles)	visits per visitor per year	visitors per capita per year	total participation rate	total visitor-days	cumulative visitation: number percent
Marion	TX	Jefferson	9,964	26	16.4094	0.6666	10.4161	103,964	103,964 6.29%
Camp	TX	Pittsburg	9,904	30	12.6026	0.3928	6.0666	60,169	164,164 12.28%
Harrison	TX	Marshall	67,463	30	12.6926	0.3929	6.0666	291,163	446,337 36.61%
Morris	TX	Daingerfield	13,200	30	12.6926	0.3920	6.0666	66,666	612,202 40.64%
Upshur	TX	Gilmer	31,370	30	12.6926	0.3929	6.0666	166,906	671,106 63.61%
Gregg	TX	Longview	104,946	36	0.6669	0.2667	2.7616	269,622	880,931 76.62%
Cass	TX	Atlanta	29,982	39	7.7744	0.2326	1.6076	54,191	1,015,122 80.94%
Titus	TX	Mount Pleasant	24,009	60	4.6697	0.1414	0.6666	16,637	1,031,659 62.26%
Wood	TX	Quitman	29,390	67	3.6293	0.1066	0.4169	12,246	1,043,904 63.24%
Panola	TX	Carthage	22,036	61	3.3666	0.0960	0.3220	7,096	1,051,000 63.60%
Bowie	TX	Texarkana	61,666	64	3.1112	0.0663	0.2696	21,936	1,072,935 66.66%
Rusk	TX	Henderson	43,376	66	3.0271	0.0837	0.2634	10,969	1,083,924 66.43%
Franklin	TX	Mount Vernon	7,602	66	2.9469	0.0812	0.2302	1,666	1,085,790 66.66%
Caddo	LA	Shreveport	269,666	69	2.7967	0.0766	0.2130	67,670	1,143,469 91.16%
Miller	AR	Texarkana	38,913	70	2.6693	0.0722	0.1919	7,660	1,161,129 91.79%
Red River	TX	Clarksville	14,317	71	2.6049	0.0701	0.1620	2,606	1,163,735 92.00%
Smith	TX	Tyler	161,309	71	2.6949	0.0701	0.1620	27,642	1,181,277 94.19%
Bossier	LA	Bossier City	91,108	74	2.4171	0.0646	0.1661	14,220	1,195,497 96.33%
Hopkins	TX	Sulphur Springs	29,833	67	1.6473	0.0467	0.0663	2,466	1,197,985 96.62%
Hunt	TX	Greenville	64,343	96	1.6316	0.0366	0.0664	3,626	1,201,613 96.61%
Nacogdoches	TX	Nacogdoches	64,763	106	1.3609	0.0316	0.0426	2,346	1,203,958 96.00%
Henderson	TX	Athens	69,643	107	1.3422	0.0309	0.0416	2,427	1,206,385 96.19%
San Augustine	TX	San Augustine	7,999	107	1.3422	0.0309	0.0416	332	1,208,717 96.22%
Fannin	TX	Bonham	24,604	116	1.2008	0.0267	0.0323	602	1,207,519 96.29%
Anderson	TX	Palestine	49,024	110	1.1636	0.0260	0.0266	1,363	1,208,903 96.40%
Angelina	TX	Lufkin	69,664	122	1.1146	0.0236	0.0266	1,661	1,210,764 96.64%
Grayson	TX	Sherman	96,021	143	0.0066	0.0173	0.0167	1,403	1,212,248 96.66%
Houston	TX	Crockett	21,376	166	0.6264	0.0147	0.0122	260	1,212,506 96.66%
Collin	TX	McKinney	23,967	166	0.6204	0.0146	0.0119	266	1,212,792 96.71%
Dallas	TX	Dallas	1,852,810	160	0.7976	0.0136	0.0110	20,410	1,233,202 96.33%
Tarrant	TX	Fort Worth	1,170,103	190	0.6693	0.0098	0.0066	7,671	1,240,873 98.94%
Brazos	TX	Bryan	121,662	212	0.6076	0.0079	0.0046	663	1,241,465 98.99%
Jefferson	TX	Beaumont	239,397	229	0.6719	0.0067	0.0039	923	1,242,379 99.06%
Hood	TX	Granbury	26,991	231	0.6692	0.0066	0.0036	109	1,242,488 99.07%
Harris	TX	Houston	2,818,199	241	0.6610	0.0061	0.0034	9,464	1,261,942 99.63%
Grimes	TX	Anderson	19,626	246	0.6402	0.0067	0.0031	66	1,252,000 90.63%
Archer	TX	Archer City	7,973	261	0.4996	0.0046	0.0022	16	1,252,018 99.63%
Washington	TX	Brenham	26,164	262	0.4988	0.0044	0.0022	66	1,262,076 99.64%
Brazoria	TX	Brazosport	191,707	291	0.4900	0.0042	0.0020	392	1,252,469 99.67%
Travis	TX	Austin	676,407	291	0.4900	0.0042	0.0020	1,179	1,253,648 99.96%
Burnet	TX	Burnet	22,677	297	0.4647	0.0040	0.0019	44	1,263,692 99.07%
Lavaca	TX	Hallettsville	16,690	363	0.4473	0.0026	0.0013	24	1,263,716 99.97%
Gray	TX	Pampa	23,967	466	0.4113	0.0017	0.0007	17	1,263,733 99.97%
Lubbock	TX	Lubbock	222,636	462	0.4063	0.0016	0.0006	137	1,263,870 99.96%
Midland	TX	Midland	106,611	467	0.4043	0.0016	0.0006	64	1,263,934 99.99%
Ector	TX	Odessa	116,934	606	0.4010	0.0014	0.0006	66	1,264,000 99.99%
Potter	TX	Amarillo	97,674	617	0.3990	0.0013	0.0006	62	1,264,062 100.00%
Randall	TX	Amarillo	69,673	617	0.3990	0.0013	0.0006	47	1,264,099 100.00%
Crane	TX	Crane	4,662	639	0.3966	0.0012	0.0006	2	1,264,102 100.00%
Moore	TX	Dumas	17,666	666	0.3920	0.0011	0.0004	6	1,264,109 100.00%

Table 10.
Total Participation Rate and Visitor-Days,
Big Cypress Bayou

county		principal population center	1990 population	approx. 1-way travel distance (miles)	visits per visitor per year	visitors per capita per year	total participation rate	total visitor-days	cumulative visitation: number	percent
Marion	TX	Jefferson	9,984	6	4.3632	0.6742	2.0662	20,606	29,606	84.67%
Harrison	TX	Marshall	67,463	16	1.0066	0.0742	0.0747	4,293	33,796	96.99%
Cass	TX	Atlanta	29,982	31	0.3732	0.0169	0.0063	167	33,985	97.63%
Morris	TX	Dangerfield	13,200	36	0.2760	0.0106	0.0029	36	34,024	97.64%
Gregg	TX	Longview	104,948	39	0.2646	0.0100	0.0026	277	34,301	96.44%
Upshur	TX	Gilmer	31,370	49	0.1676	0.0080	0.0011	36	34,336	96.64%
Panola	TX	Carthage	22,036	61	0.1769	0.0066	0.0010	21	34,366	96.60%
Camp	TX	Pittsburg	9,904	64	0.1623	0.0048	0.0006	8	34,366	98.82%
Caddo	LA	Shreveport	289,888	64	0.1623	0.0048	0.0006	210	34,676	99.23%
Bowie	TX	Texarkana	81,685	66	0.1637	0.0044	0.0007	66	34,631	99.36%
Miller	AR	Texarkana	39,013	66	0.1637	0.0044	0.0007	27	34,660	99.46%
Rusk	TX	Haddam	43,376	67	0.1497	0.0043	0.0008	26	34,666	99.64%
Titus	TX	Mount Pleasant	24,009	66	0.1466	0.0041	0.0006	14	34,701	99.58%
Bossier	LA	Bossier City	91,108	62	0.1320	0.0036	0.0006	42	34,743	99.70%
Franklin	TX	Mount Vernon	7,802	74	0.1012	0.0024	0.0002	2	34,746	99.71%
Smith	TX	Tyler	161,309	76	0.0992	0.0023	0.0002	34	34,779	99.81%
Wood	TX	Quitman	29,360	80	0.0900	0.0020	0.0002	6	34,784	90.62%
Hopkins	TX	Sulphur Springs	28,833	96	0.0696	0.0013	0.0001	3	34,767	98.63%
San Augustine	TX	San Augustine	7,999	07	0.0674	0.0013	0.0001	1	34,766	99.63%
Red River	TX	Clarksville	14,317	99	0.0664	0.0012	0.0001	1	34,769	90.64%
Nacogdoches	TX	Nacogdoches	64,763	100	0.0644	0.0012	0.0001	4	34,793	99.85%
Henderson	TX	Athens	66,643	111	0.0661	0.0009	0.0001	3	34,706	99.88%
Angelina	TX	Lufkin	69,884	119	0.0466	0.0008	0.0000	3	34,799	99.87%
Anderson	TX	Palestine	46,024	121	0.0464	0.0006	0.0006	2	34,601	99.87%
Hunt	TX	Greenville	64,343	126	0.0466	0.0007	0.0000	2	34,603	99.66%
Fannin	TX	Bonham	24,804	143	0.0377	0.0006	0.0000	1	34,804	99.66%
Houston	TX	Crockett	21,376	162	0.0344	0.0006	0.0000	0	34,804	99.88%
Collin	TX	McKinney	23,967	159	0.0321	0.0004	0.0000	0	34,804	99.88%
Dallas	TX	Dallas	1,852,810	164	0.0307	0.0004	0.0000	22	34,627	99.96%
Grayson	TX	Sherman	96,021	171	0.0288	0.0004	0.0000	1	34,626	99.95%
Tarrant	TX	Fort Worth	1,170,103	194	0.0238	0.0003	0.0000	6	34,636	99.97%
Jefferson	TX	Beaumont	239,397	216	0.0200	0.0002	0.0000	1	34,636	99.97%
Brazos	TX	Bryan	121,862	226	0.0190	0.0002	0.0000	0	34,637	99.97%
Hood	TX	Granbury	28,981	236	0.0179	0.0002	0.0000	0	34,637	99.07%
Grimes	TX	Anderson	18,626	236	0.0178	0.0002	0.0000	0	34,837	99.97%
Harris	TX	Houston	2,818,199	243	0.0170	0.0002	0.0000	6	34,846	100.00%
Washington	TX	Brenham	28,164	289	0.0146	0.0001	0.0000	0	34,646	100.00%
Travis	TX	Austin	676,407	296	0.0127	0.0001	0.0000	1	34,646	100.00%
Burnet	TX	Burnet	22,677	301	0.0123	0.0001	0.0000	0	34,846	100.00%
Brazoria	TX	Brazosport	191,707	306	0.0121	0.0001	0.0000	0	34,646	100.00%
Archer	TX	Archer city	7,973	309	0.0115	0.0001	0.0000	0	34,646	100.00%
Lavaca	TX	Hallettsville	16,690	366	0.0096	0.0001	0.0000	0	34,646	100.00%
Lubbock	TX	Lubbock	222,636	488	0.0080	0.0000	0.0000	0	34,848	100.00%
Midland	TX	Midland	106,611	491	0.0069	0.0000	0.0000	0	34,646	100.00%
Gray	TX	Pampa	23,967	494	0.0069	0.0000	0.0000	0	34,646	100.00%
Ector	TX	Odessa	116,934	611	0.0066	0.0000	0.0000	0	34,646	100.00%
Potter	TX	Amarillo	97,674	621	0.0064	0.0000	0.0000	0	34,646	100.00%
Randall	TX	Amarillo	68,673	621	0.0064	0.0000	0.0000	0	34,848	100.00%
Crane	TX	Crane	4,662	643	0.0061	0.0000	0.0000	0	34,646	100.00%
Moore	TX	Dumas	17,866	670	0.0047	0.0000	0.0000	0	34,646	100.00%

**Table 11.
Total Participation Rate and Visitor-Days,
Caddo Lake**

county		principal population center	1990 population	approx. 1-way travel distance (miles)	visits per visitor per year	visitors per capita per year	total participation rate	total visitor-days	cumulative visitation: number	percent
Marion	TX	Jefferson	9,984	18	8.8494	0.6820	6.1606	61,423	61,423	8.68%
Harrison	TX	Marshall	57,483	20	7.3870	0.3886	2.8772	166,388	218,811	38.81%
Cass	TX	Atlanta	29,982	36	4.7864	0.1422	0.6807	20,408	237,218	40.08%
Caddo	LA	Shreveport	269,688	35	4.4188	0.1171	0.6170	138,441	378,880	83.80%
Gregg	TX	Longview	104,848	43	4.1134	0.0982	0.4039	42,392	419,052	70.78%
Bossier	LA	Bossier City	81,106	47	3.8694	0.0837	0.3228	29,420	448,473	76.73%
Morris	TX	Daingerfield	13,200	48	3.8022	0.0808	0.3083	4,043	462,618	78.41%
Panola	TX	Carthage	22,036	66	3.4674	0.0831	0.2180	4,804	457,319	77.23%
Upshur	TX	Gilmer	31,370	69	3.2064	0.0668	0.1831	6,744	483,064	78.20%
Bowie	TX	Texarkana	81,886	80	3.2682	0.0639	0.1767	14,346	477,408	80.82%
Miller	AR	Texarkana	30,913	80	3.2682	0.0639	0.1767	7,011	484,419	81.80%
Rusk	TX	Henderson	43,376	81	3.2220	0.0823	0.1888	7,314	491,733	83.04%
Camp	TX	Pittsburg	8,004	84	3.1201	0.0480	0.1498	1,483	493,216	83.28%
Titus	TX	Mount Pleasant	24,009	88	2.9978	0.0430	0.1280	3,097	498,313	83.81%
Smith	TX	Tyler	161,305	75	2.7217	0.0329	0.0804	13,631	509,844	88.10%
Franklin	TX	Mount Vernon	7,802	84	2.6190	0.0204	0.0771	801	610,446	86.20%
Wood	TX	Quitman	29,380	50	2.6102	0.0280	0.0862	1,918	612,382	88.62%
San Augustine	TX	San Augustine	7,989	101	2.3428	0.0211	0.0495	398	612,767	88.69%
Nacogdoches	TX	Nacogdoches	64,763	104	2.3030	0.0200	0.0481	2,628	616,283	87.01%
Hopkins	TX	Sulphur Springs	28,833	106	2.2902	0.0187	0.0461	1,300	618,683	87.23%
Red River	TX	Clarksville	14,317	109	2.2413	0.0184	0.0413	681	617,174	87.33%
Henderson	TX	Athens	68,643	116	2.1740	0.0187	0.0383	2,127	610,301	87.89%
Angelina	TX	Lufkin	69,884	123	2.0940	0.0148	0.0310	2,187	621,488	88.06%
Anderson	TX	Palestine	48,024	126	2.0768	0.0144	0.0288	1,434	622,902	88.30%
Hunt	TX	Greenville	84,343	138	1.9832	0.0124	0.0248	1,677	624,478	88.67%
Fannin	TX	Bonham	24,804	163	1.8864	0.0100	0.0187	483	624,942	88.84%
Houston	TX	Crockett	21,376	168	1.8472	0.0097	0.0178	381	626,323	88.71%
Dallas	TX	Dallas	1,852,810	188	1.7804	0.0084	0.0160	27,870	663,193	93.42%
Collin	TX	McKinney	23,987	169	1.7762	0.0084	0.0148	366	663,649	93.48%
Grayson	TX	Sherman	96,021	181	1.7176	0.0074	0.0127	1,208	664,764	93.68%
Tarrant	TX	Fort Worth	1,170,103	188	1.8472	0.0083	0.0104	12,116	688,870	86.72%
Jefferson	TX	Beaumont	239,397	222	1.6866	0.0061	0.0080	1,917	688,787	86.06%
Brazos	TX	Bryan	121,882	230	1.6418	0.0048	0.0074	802	689,689	88.20%
Hood	TX	Granbury	28,981	238	1.6171	0.0046	0.0068	187	689,886	88.23%
Grimes	TX	Anderson	18,828	239	1.6171	0.0046	0.0068	128	670,014	08.28%
Harris	TX	Houston	2,818,199	247	1.4985	0.0042	0.0083	17,806	687,819	99.28%
Washington	TX	Brenham	28,164	273	1.4378	0.0036	0.0061	133	687,062	09.28%
Travis	TX	Austin	678,407	299	1.3884	0.0030	0.0042	2,386	600,347	99.69%
Burnet	TX	Burnet	22,877	306	1.3782	0.0029	0.0040	50	690,438	90.70%
Brazoria	TX	Brazosport	191,707	309	1.3718	0.0028	0.0039	742	691,178	99.83%
Archer	TX	Archer City	7,973	313	1.3861	0.0028	0.0038	30	691,209	99.83%
Lavaca	TX	Hallettsville	18,690	368	1.3009	0.0022	0.0028	62	691,282	99.84%
Lubbock	TX	Lubbock	222,838	490	1.1816	0.0012	0.0016	324	691,686	99.90%
Midland	TX	Midland	108,811	495	1.1781	0.0012	0.0014	162	691,737	99.92%
Gray	TX	Pampa	23,987	498	1.1782	0.0012	0.0014	34	691,771	99.93%
Ector	TX	Odessa	118,834	616	1.1853	0.0011	0.0013	168	691,827	99.96%
Potter	TX	Amarillo	87,874	626	1.1693	0.0011	0.0013	123	602,060	99.98%
Randall	TX	Amarillo	88,873	626	1.1693	0.0011	0.0013	113	692,183	100.00%
Crane	TX	Crane	4,862	647	1.1487	0.0010	0.0012	6	692,188	100.00%
Moore	TX	Dumas	17,866	674	1.1326	0.0009	0.0010	19	602,187	100.00%

Tables 12, 13, and 14 display projected population and visitor-days for each reach. (Since the total participation rate for each county is assumed to be constant over time, recreation visitation is simply proportional to population.) The three reaches generated an estimated 2.1 million recreation visitor-days in 1990, with Lake O' The Pines accounting for about two-thirds of the total, and Caddo Lake for one-third. This total would increase to about three million visitor-days by 2050.

As shown, adjustments to total visitor-days were made for Lake O' The Pines and Caddo Lake, to account for visitation originating outside the nominal study area. In the case of Lake O' The Pines, total 1987 visitation at the project was known from survey data collected at that time to be 1.4 million, and the difference between that total and the estimate for the study area was assumed to represent visitation originating from distant areas in Texas and the remainder of the United States. The proportional difference between total 1987 visitation and estimated 1987 visitation for the study area was assumed to remain constant over time. In the case of Caddo Lake, the adjustment represented the difference between estimated visitor-days for the study area, and visitor-days for all counties reporting visitation in the TPWD data, based on 1990 populations. Again, the proportional difference was assumed to remain constant over time.

Consolidation of Reaches.

The statistical relationships resulting from the above analyses were substantially different for each of the reaches, reflecting the physical and qualitative differences in their recreation experiences, despite their relatively close proximity to each other. The relationships for Big Cypress Bayou, however, were based on extremely small sample sizes for many counties of origin, and (in the case of participation rates) had poor overall explanatory power. Moreover, they suggested that Big Cypress Bayou received virtually no visitation from any but the most immediate local areas, and that at a low level. This was in strong disagreement with interview information from recreation purveyors and business owners in that area, as well as direct field observation. Reconciling this conflicting data led to two conclusions: (1) visitation to Big Cypress Bayou is underrepresented in the TPWD survey data because it is almost never a primary destination, but is visited incidentally by visitors to Lake O' The Pines or Caddo Lake; and (2) visitation to Big Cypress Bayou, as surveyed, is severely constrained by lack of access and recreation resource development. Consequently, recreation demand for Big Cypress Bayou upstream of Jefferson, Texas was considered to be represented by the Lake O' The Pines demand model, and by the Caddo Lake demand model for the reach downstream of Jefferson. (In the absence of any specific data, Twelve Mile Bayou was similarly considered to be represented by the Caddo Lake demand model.)

Table 12.
Projected Population and Visitor-days,
Lake O' The Pines

county	state	principal population center	approx. 1-way travel distance (miles)	total visitation rate	with-project projected population:								with-project projected visitor-days:							
					1987	1990	2001	2010	2020	2030	2040	2050	1987	1990	2001	2010	2020	2030	2040	2050
Miller	AR	Texarkana	70	0.1919	39,200	39,913	44,000	47,000	50,000	52,000	53,000	54,000	7,500	7,700	8,400	9,000	9,600	10,000	10,200	10,400
Bossier	LA	Bossier City	74	0.1561	90,550	91,106	104,000	111,000	116,000	122,000	125,000	128,000	14,100	14,200	16,200	17,300	18,100	19,000	19,500	20,000
Caddo	LA	Shreveport	68	0.2139	269,850	269,688	307,000	328,000	344,000	360,000	369,000	378,000	57,700	57,700	65,700	70,200	73,600	77,000	78,900	80,800
Bowie	TX	Texarkana	64	0.2686	79,137	81,685	88,000	95,000	99,000	104,000	106,000	109,000	21,300	21,900	23,800	25,500	26,800	27,900	28,500	29,300
Camp	TX	Pittsburg	30	5.0656	10,115	9,904	12,000	13,000	14,000	14,000	15,000	15,000	51,200	50,200	60,800	65,900	70,900	70,900	76,000	76,000
Cass	TX	Atlanta	39	1.8075	30,294	29,982	36,000	38,000	41,000	42,000	44,000	45,000	54,800	54,200	65,100	68,700	74,100	75,900	79,500	81,300
Franklin	TX	Mount Vernon	66	0.2392	7,648	7,802	8,000	10,000	10,000	11,000	11,000	11,000	1,800	1,900	1,900	2,400	2,400	2,600	2,600	2,600
Gregg	TX	Longview	35	2.7616	110,344	104,948	129,000	139,000	147,000	154,000	158,000	163,000	304,700	289,800	356,200	383,900	406,000	425,300	436,300	450,100
Harrison	TX	Marshall	30	5.0656	57,356	57,483	68,000	74,000	78,000	82,000	84,000	87,000	290,500	291,200	344,500	374,900	395,100	415,400	425,500	440,700
Hopkins	TX	Sulphur Springs	87	0.0863	28,598	28,833	35,000	38,000	40,000	41,000	43,000	44,000	2,500	2,500	3,000	3,300	3,500	3,500	3,700	3,800
Marion	TX	Jefferson	25	10.4151	9,293	9,984	11,000	12,000	13,000	13,000	14,000	14,000	96,800	104,000	114,600	125,000	135,400	135,400	145,800	145,800
Morris	TX	Dangerfield	30	5.0656	13,609	13,200	17,000	18,000	19,000	20,000	20,000	21,000	68,900	66,900	86,100	91,200	96,200	101,300	101,300	106,400
Panola	TX	Carthage	61	0.3220	21,799	22,035	28,000	28,000	30,000	31,000	32,000	33,000	7,000	7,100	9,000	9,000	9,700	10,000	10,300	10,600
Red River	TX	Clarkeville	71	0.1820	15,488	14,317	18,000	19,000	20,000	21,000	22,000	22,000	2,800	2,800	3,300	3,500	3,600	3,800	4,000	4,000
Rusk	TX	Henderson	65	0.2534	43,347	43,375	50,000	54,000	57,000	59,000	61,000	63,000	11,000	11,000	12,700	13,700	14,400	14,900	15,500	16,000
Smith	TX	Tyler	71	0.1820	150,464	151,309	187,000	201,000	212,000	222,000	229,000	235,000	27,400	27,500	34,000	36,600	38,600	40,400	41,700	42,800
Titus	TX	Mount Pleasant	50	0.6888	23,129	24,009	27,000	29,000	31,000	32,000	33,000	34,000	15,900	16,500	18,600	20,000	21,400	22,000	22,700	23,400
Upshur	TX	Gilmer	30	5.0656	30,526	31,370	38,000	41,000	43,000	45,000	46,000	47,000	154,800	158,900	192,500	207,700	217,800	227,900	233,000	238,100
Wood	TX	Quitman	57	0.4168	28,279	29,380	34,000	37,000	39,000	41,000	42,000	43,000	11,800	12,200	14,200	15,400	16,300	17,100	17,500	17,900
Subtotal, Study Area					1,059,016	1,060,302	1,241,000	1,332,000	1,403,000	1,466,000	1,507,000	1,546,000	1,202,300	1,198,000	1,430,400	1,543,200	1,633,300	1,700,300	1,752,500	1,800,000
Other Areas													206,900	206,200	246,200	265,600	281,100	282,600	301,800	309,800
Total													1,409,200	1,404,200	1,676,600	1,808,800	1,914,400	1,982,900	2,054,100	2,109,800

Table 13.
Projected Population and Visitor-days,
Big Cypress Bayou

county	state	principal population center	approx. 1-way travel distance (miles)	total visitation rate	with-project projected population:							with-project projected visitor-days:						
					1990	2001	2010	2020	2030	2040	2050	1990	2001	2010	2020	2030	2040	2050
Miller	AR	Texarkana	56	0.0007	39,913	44,000	47,000	50,000	52,000	53,000	54,000	0	0	0	0	0	0	0
Bossier	LA	Bossier City	62	0.0005	91,106	104,000	111,000	116,000	122,000	125,000	128,000	0	0	100	100	100	100	100
Caddo	LA	Shreveport	54	0.0008	269,688	307,000	328,000	344,000	360,000	369,000	378,000	200	200	300	300	300	300	300
Bowie	TX	Texarkana	56	0.0007	81,665	88,000	95,000	99,000	104,000	106,000	109,000	100	100	100	100	100	100	100
Camp	TX	Pittsburg	54	0.0008	9,904	12,000	13,000	14,000	14,000	15,000	15,000	0	0	0	0	0	0	0
Cass	TX	Atlanta	31	0.0063	29,982	36,000	38,000	41,000	42,000	44,000	45,000	200	200	200	300	300	300	300
Franklin	TX	Mount Vernon	74	0.0002	7,802	8,000	10,000	10,000	11,000	11,000	11,000	0	0	0	0	0	0	0
Gregg	TX	Longview	39	0.0026	104,948	129,000	139,000	147,000	154,000	158,000	163,000	300	300	400	400	400	400	400
Harrison	TX	Marshall	16	0.0747	57,483	68,000	74,000	78,000	82,000	84,000	87,000	4,300	5,100	5,500	5,800	6,100	6,300	6,500
Hopkins	TX	Sulphur Springs	95	0.0001	28,833	35,000	38,000	40,000	41,000	43,000	44,000	0	0	0	0	0	0	0
Marion	TX	Jefferson	6	2.9552	9,984	11,000	12,000	13,000	13,000	14,000	14,000	29,500	32,500	35,500	38,400	38,400	41,400	41,400
Morris	TX	Deingerfield	38	0.0029	13,200	17,000	18,000	19,000	20,000	20,000	21,000	0	0	100	100	100	100	100
Panola	TX	Carthage	51	0.0010	22,035	28,000	28,000	30,000	31,000	32,000	33,000	0	0	0	0	0	0	0
Red River	TX	Clarkeville	99	0.0001	14,317	18,000	19,000	20,000	21,000	22,000	22,000	0	0	0	0	0	0	0
Rusk	TX	Henderson	57	0.0006	43,375	50,000	54,000	57,000	59,000	61,000	63,000	0	0	0	0	0	0	0
Smith	TX	Tyler	75	0.0002	151,309	187,000	201,000	212,000	222,000	228,000	235,000	0	0	0	0	100	100	100
Titus	TX	Mount Pleasant	58	0.0006	24,009	27,000	29,000	31,000	32,000	33,000	34,000	0	0	0	0	0	0	0
Upshur	TX	Gilmer	49	0.0011	31,370	38,000	41,000	43,000	45,000	46,000	47,000	0	0	0	0	100	100	100
Wood	TX	Quitman	80	0.0002	29,380	34,000	37,000	39,000	41,000	42,000	43,000	0	0	0	0	0	0	0
					1,060,302	1,241,000	1,332,000	1,403,000	1,466,000	1,507,000	1,546,000	34,600	38,400	42,200	45,500	46,000	49,200	49,400

Table 14.
Projected Population and Visitor-days,
Caddo Lake

county	state	principal population center	approx. 1-way travel distance (miles)	total visitation rate	with-project projected population:							with-project projected visitor-days:						
					1990	2001	2010	2020	2030	2040	2050	1990	2001	2010	2020	2030	2040	2050
Miller	AR	Texarkana	80	0.1757	39,913	44,000	47,000	50,000	52,000	53,000	54,000	7,000	7,700	8,300	8,800	9,100	9,300	9,500
Boesler	LA	Boesler City	47	0.3229	91,108	104,000	111,000	116,000	122,000	125,000	128,000	29,400	33,800	35,800	37,500	39,400	40,400	41,300
Caddo	LA	Shreveport	39	0.5170	269,688	307,000	328,000	344,000	360,000	369,000	378,000	139,400	158,700	169,800	177,900	186,100	190,800	195,400
Bowie	TX	Texarkana	80	0.1757	81,665	88,000	95,000	99,000	104,000	106,000	109,000	14,300	15,500	16,700	17,400	18,300	18,600	19,100
Camp	TX	Pittsburg	64	0.1498	9,904	12,000	13,000	14,000	14,000	15,000	15,000	1,500	1,800	1,900	2,100	2,100	2,200	2,200
Cass	TX	Atlanta	35	0.6807	29,982	36,000	38,000	41,000	42,000	44,000	45,000	20,400	24,600	25,900	27,900	28,800	29,000	30,600
Franklin	TX	Mount Vernon	84	0.0771	7,802	8,000	10,000	10,000	11,000	11,000	11,000	800	800	800	800	800	800	800
Gregg	TX	Longview	43	0.4039	104,948	129,000	139,000	147,000	154,000	158,000	163,000	42,400	52,100	56,100	59,400	62,200	63,800	65,800
Harrison	TX	Marshall	20	2.8772	57,483	68,000	74,000	78,000	82,000	84,000	87,000	185,400	195,600	212,900	224,400	235,900	241,700	250,300
Hopkins	TX	Sulphur Springs	105	0.0451	28,833	35,000	38,000	40,000	41,000	43,000	44,000	1,300	1,800	1,700	1,800	1,800	1,900	2,000
Marion	TX	Jefferson	16	5.1505	9,984	11,000	12,000	13,000	13,000	14,000	14,000	51,400	58,700	61,800	67,000	67,000	72,100	72,100
Morris	TX	Daingerfield	48	0.3063	13,200	17,000	18,000	19,000	20,000	20,000	21,000	4,000	5,200	5,500	5,800	6,100	6,100	6,400
Panola	TX	Carthage	55	0.2180	22,035	28,000	28,000	30,000	31,000	32,000	33,000	4,800	6,100	6,100	6,500	6,800	7,000	7,200
Red River	TX	Clarksville	109	0.0413	14,317	18,000	19,000	20,000	21,000	22,000	22,000	800	700	800	800	900	900	900
Rusk	TX	Henderson	61	0.1888	43,375	50,000	54,000	57,000	59,000	61,000	63,000	7,300	8,400	9,100	9,600	9,900	10,300	10,000
Smith	TX	Tyler	79	0.0894	151,309	187,000	201,000	212,000	222,000	228,000	235,000	13,500	16,700	18,000	19,000	19,900	20,500	21,000
Titus	TX	Mount Pleasant	68	0.1290	24,009	27,000	28,000	31,000	32,000	33,000	34,000	3,100	3,500	3,700	4,000	4,100	4,300	4,400
Upshur	TX	Gilmer	59	0.1831	31,370	38,000	41,000	43,000	45,000	48,000	47,000	6,700	7,000	7,500	7,900	8,200	8,400	8,800
Wood	TX	Quitman	90	0.0652	29,380	34,000	37,000	39,000	41,000	42,000	43,000	1,800	2,200	2,400	2,500	2,700	2,700	2,800
Subtotal, Study Area					1,080,302	1,241,000	1,332,000	1,403,000	1,466,000	1,507,000	1,546,000	514,000	598,200	644,800	681,100	709,900	731,800	751,000
Other Areas												78,200	91,000	98,100	103,600	108,000	111,300	114,300
Total												592,200	689,200	742,700	784,700	817,900	843,100	865,300

GROSS FACILITY NEEDS

Peak Day Demand.

The modeled total recreation visitor-days for each site was disaggregated into annual activity-days by major recreation activity category, based on the proportions shown in the TPWD raw sample data. See Tables 18 and 19 (discussed below). The resulting projections of annual activity-days were converted to peak-day activity-days, using summary data from recreation visitor surveys conducted at Lake O' The Pines in 1986 and 1987 (displayed in Table 15), on the assumption that the Lake O' The Pines data would apply to the other reaches of the study area.

Table 15.
Percent of Total Year Activity-Days
Occurring on Peak Day,
Lake O' The Pines (1986-87)

	avg. persons per party	peak day parties	total year parties	peak day % of total year
camping	2.43	764	52,951	1.44%
picnicking	3.14	882	45,947	1.92%
hiking	1.00	485	47,917	1.01%
nature study	1.00	723	41,590	1.74%
swimming	1.00	6,027	274,566	2.20%
shore fishing	1.00	1,208	107,360	1.13%
boat fishing	2.06	3,061	272,118	1.12%
boating	2.06	2,126	184,256	1.15%

Facility Standards.

Facility standards are the units of facilities or resources required to support various recreational activities. For most kinds of facilities, peak-day activity-days were converted to gross facility requirements using peak-use load factors in *Guidelines for Understanding and Determining Optimum Recreation Carrying Capacity* (U.S. Bureau of Outdoor Recreation, January 1977). One of the goals of that study was to determine a range of optimum recreation resource capacities – “the amount of recreation use of a recreation resource which reflects the level of use most appropriate for both the protection of the resource and the satisfaction of the participant” – for a wide variety of outdoor recreation activities. This determination was based on research literature review, evaluation of existing recreation facility capacity standards, and interviews with recreation administrators, planners, and participants. The report suggested a range of optimum instantaneous peak-use load capacity values for each recreation activity, specifying “low”, “base”, and “high” intensity utilization of the resource in question. The present analysis uses the “base” peak-use load factors given in that report. Additional load factor information was derived from *1990 TORP – Assessment and Policy Plan* (Texas Parks and Wildlife Department, 1990), and *Bayou DeSiard Recreation Demand Study* (U.S. Army Waterways Experiment Station, September 1984). The specific load factors used are displayed in Table 16.

Table 16.
Facility Requirements Criteria

activity	for peak day parties:		turnover rate	for peak day persons:	
	units	number		units	number
camping	campsites/acre	7	1.00	persons/acre	17.02
picnicking	tables/acre	13	1.80	persons/acre	73.48
hiking	parties/trail mile	12	4.60	persons/trail mile	55.20
nature study	parties/trail mile	12	4.60	persons/trail mile	55.20
swimming	swimmers/water acre	435.6	2.20	persons/water acre	958.32
shore fishing	fishermen/shoreline foot	0.033	1.70	persons/shoreline foot	0.057
boat fishing	boats/water acre	2	1.80	persons/water acre	7.41
boating	parties/lane	20	n/a	persons/lane	41.16
	boats/water acre	0.15	2.40	persons/water acre	0.741
horseback riding	parties/trail mile	5.5	2.11	persons/trail mile	11.61

The conversions shown from peak day parties to peak day persons are based on the number of persons per party for each activity, as shown in Table 15, and the daily turnover rate for each activity, from the Bureau of Outdoor Recreation report discussed above and the Lake O' The Pines survey data. For boating lanes, for which no daily turnover rate is shown, it is assumed that each lane has a capacity of five launches per hour, and that the peak hour represents 25 percent of the peak day's traffic.

The general considerations for each recreation activity are summarized below.

Camping, Multi Use: These areas are intended to service recreational vehicles. Each site will have a paved pullout, delineated impact area with table grill, fire ring, lantern holder, utility table, restrooms and showers. Pullouts will vary in length and overflow parking areas will be provided for campers bringing additional vehicles.

Camping, Tent: These areas are designed for tent campers and consist of walk-in campsites complete with picnic table, impact area, grill, and tent pad, and feature centralized restrooms with showers. Cars will be parked in clustered parking lots.

Picnicking: Picnicking is defined as an outdoor activity where the primary purpose is the preparation and/or eating of meals. These areas are intended to serve as individual facility or small group areas. Each site will consist of a defined impact area with table and grill.

Multi-Use Trails: These trails offer a natural hike/bike experience and usually provide access to primitive campsites, bank fishing, and scenic areas. These trails will be constructed to provide a clear tread width of eight feet and a ten foot high clearance.

Shore Fishing: Shore fishing is described as fishing that occurs along a freshwater body, either on the shore or on structures associated with that resource.

Boat Fishing: The category boat fishing is defined as the act of fishing from a boat in a freshwater setting for a non-commercial purpose.

Boat Launch Lanes: These areas will consist of boat ramps, parking, restrooms and courtesy docks. Boat ramps will be constructed of concrete and will be located so as to

minimize hazards to boating operations. Counesy docks will be provided at all boat launching ramps whenever possible.

Horseback Riding: In most cases, equestrian trails are incompatible with other trail types and should be designed so as not to conflict with them. The surface of equestrian trails shall consist of compacted materials, resistant to normal use and erosion, usable when wet and not dusty when dry. If possible, use of existing natural material or grass is preferred. Erosion control and stabilization shall be given high priority in the design and construction of these trails and vegetation growth should be encouraged as much as possible to stabilize all areas adjacent to the trail not receiving foot traffic. Rest areas will be provided along the trails and located so as not to result in degradation of scenic resources or adjacent areas.

Facility Needs.

For each recreation activity, projected annual activity-days were multiplied by the appropriate percent of total year activity-days occurring on the peak day (from Table 15), and divided by the appropriate facility standard (from Table 16) to obtain the number of units that would optimally support the activity. See Tables 18 and 19 (discussed below).

RESOURCE INVENTORY AND ANALYSIS

Land uses along the project area vary. Near Shreveport, Louisiana, the water's edge is heavily wooded and mostly undeveloped. Soda Lake State Wildlife Management Area, a 12,000 acre parcel of land owned by the Caddo Parish Levee Board and leased to the Louisiana Department of Wildlife and Fisheries, is located approximately fifteen miles north of Shreveport along Twelve Mile Bayou. Interstate 220, Highway 71, and State Roads 173 and 169 cross over Twelve Mile Bayou at various locations. The areas under several of the bridges are used as boat access points, evidence that boat ramps are needed. People also access the water by using docks and ramps located at their homes along the river banks. Small boat ramps are also found at Caddo Lake's dam. No major constraints to development exist along most of the segment from Shreveport to Caddo Lake, except along Soda Lake State Wildlife Management Area.

The area near the spillway has been cleared of vegetation, but upstream from the dam the land and water's edge are heavily wooded with bald cypress trees. Numerous land uses exist around the lake. Caddo Lake State Park provides people with opportunities to camp, fish, boat, and study nature. The state park has a two-lane boat ramp, providing a location where the public can launch their pleasure craft. There is a high incidence of individuals who fish from their boats and a small number of people who water ski. Residences and small commercial establishments exist along the lake's perimeter, thereby reducing the land available for the development of public use facilities.

Bald cypress trees extend beyond the lake's western boundary and upstream along the banks of Big Cypress Bayou. Between Caddo Lake and Jefferson, Big Cypress Bayou was channelized by the U.S. Army Corps of Engineers in the late 1800's to facilitate travel by steamboat. The river is wider in this portion and trees

are not found growing in the water as at Caddo Lake or along the non-channelized portion of Big Cypress Bayou west of Jefferson. Houses and water access points are dispersed along the river's shores.

Between Jefferson and Lake O' The Pines, Big Cypress Bayou becomes narrower and has limited access. Cypress trees protrude through the water's surface and grow up alongside the river's tightly winding banks. Informal discussions with local citizens indicated that this portion of Big Cypress Bayou is used for canoeing, whereas motorboats use the wider portion of the river east of Jefferson. The channel is flanked by large parcels of agricultural land which primarily support cattle. These lands are prone to flooding and remain swampy for periods of time, but these conditions do not pose a constraint to development. However, the construction of a navigation channel would impact the aesthetic qualities found along a majority of Big Cypress Bayou.

Big Cypress Bayou terminates at Ferrell's Bridge Dam, located at the lower end of Lake O' The Pines, a reservoir owned and operated by the U.S. Army Corps of Engineers. Based on the master plan completed in May 1989, areas around the lake were either left undisturbed or developed into recreational amenities. Overall, the shores are tree lined and provide natural scenic beauty. Lake O' The Pines would not be as severely affected by a navigation channel as Caddo Lake.

Table 17 summarizes the existing recreation facilities available in each reach.

**Table 17.
Existing Facilities**

		Lake O' The Pines	Big Cypress Bayou	Caddo Lake
camping	(campsites)	459	0	122
picnicking	(picnic areas)	191	0	130
hiking	(trail miles)	0	0	0
nature study	(trail miles)	1	0	0
swimming	(water acres)	14	0	0
shore fishing	(shoreline feet)	150,000	0	0
boating	(boat ramp lanes)	63	3	28
horseback riding	(trail miles)	0	0	0

NET FACILITY NEEDS

The gross facility requirements were compared to the inventoried facilities existing at each site to determine net facility requirements for each site. The net facilities requirements for multi-use trails and equestrian trails, however, had to be estimated differently. The demand for these kinds of facilities could not be adequately modeled by the existing survey data, because existing facilities of these kinds are limited or nonexistent in the project area. Net facilities needs for TPWD Regions 5 and 6 (an area approximately equal to the recreation study area), as reported in the 1990 TORP, were therefore used instead.

Tables 18 and 19 summarize the projected activity-days, gross facility requirements, existing facilities, and net facility requirements for each reach.

CONCEPTUAL RECREATION DEVELOPMENT OPPORTUNITIES

Recreation development was scaled only to meet net facility requirements in the project base year of 2001. It is considered that the available data and current analyses are not adequate to support projecting facilities planning far enough into the future to provide for replacement, upgrading, or expansion of facilities over the entire economic life of the navigation project.

Any proposed recreational amenity will be located along the project rights of way. It is highly unlikely that land acquisition for recreational purposes around Caddo Lake will be possible because rights of way for this project do not extend to the lake's shoreline. This situation dictated that the overall recreational development opportunities plan be divided into two sections, one for the Louisiana portion of the study area and the other for the Texas portion.

Although it was difficult to determine the recreational needs of citizens in the Louisiana part of the study area - as stated above, there are no existing data specific to that part of the study area, and the Louisiana SCORP is too generalized to be useful in this context - field surveys and discussions with local residents indicated that specific requirements existed. For example, an area under the bridge at Interstate 220 and Red River has been used as a river access point. A need for a boat launch in this location clearly exists, so two boat ramp lanes are being proposed. In addition, twenty picnic tables will also be provided. This area would also serve as a starting point for a hike/bike trail. The path would proceed in a northerly direction and lead to another trail head location just east of Trinity Heights Christian Academy. A canoe launching area constructed here would provide access to the water. Canoes can put in at this point and pull out at the boat ramps downstream. As the trail winds its way alongside the navigation channel it will lead to Soda Lake State Wildlife Management Area. Midway between Trinity Heights Christian Academy and the state park, a topographically interesting area would provide a scenic location for a primitive campground and picnic area. Continuing within Soda Lake State Wildlife Management Area, meandering nature trails would weave their way alongside the channel. A canoe access point located at the northern end of the park and another positioned on the southern edge would permit educational opportunities to quietly explore environmentally sensitive wetlands areas. The twelve mile hike/bike path would continue northward until it terminated at another trail head location found at the intersection of Highway 169 and Twelve Mile Bayou. This location would also provide two boat ramp lanes, twenty picnic tables, and approximately 1,500 linear feet of shoreline fishing.

Table 18.
Projected Activity-Days, Gross Facility Requirements,
Existing Facilities, and Net Facility Requirements,
Lake O' The Pines

PROJECTED ACTIVITY-DAYS								
	% dist.	1990	2001	2010	2020	2030	2040	2050
camping	10.18%	143,000	170,700	184,200	194,900	202,900	209,100	214,800
picnicking	8.75%	122,900	146,700	168,300	187,500	174,400	179,800	184,600
hiking	0.70%	9,600	11,700	12,800	13,400	13,900	14,300	14,700
nature study	2.37%	33,300	38,800	42,900	46,400	47,300	48,700	60,000
swimming	31.17%	437,700	522,800	583,800	598,700	621,200	640,300	657,700
shore fishing	9.06%	127,100	161,600	163,600	173,300	160,400	188,000	191,000
boat fishing	18.11%	264,300	303,600	327,500	346,700	360,800	372,000	382,000
boating	19.67%	278,100	329,700	366,700	376,600	391,900	403,900	414,900
TOTAL		1,404,200	1,678,600	1,808,800	1,914,400	1,992,900	2,054,100	2,109,800
PEAK DAY GROSS FACILITY REQUIREMENTS								
	facility units	1990	2001	2010	2020	2030	2040	2060
camping	(campsites)	849	1,013	1,093	1,167	1,204	1,241	1,276
picnicking	(picnic areas)	417	498	538	589	682	611	627
hiking	(trail miles)	2	2	2	2	3	3	3
nature study	(trail miles)	10	13	14	14	16	16	16
swimming	(water acres)	10	12	13	14	14	16	16
shore fishing	(shoreline feet)	26,237	30,142	32,626	34,411	36,621	36,833	37,926
boat fishing	(water acres)	388	461	487	626	548	565	580
boating	(boat ramp lanes)	77	82	100	106	110	113	116
bating	(water acres)	4,300	6,136	6,640	5,884	6,104	6,290	6,462
EXISTING FACILITIES								
	facility units							
camping	(campsites)	468						
picnicking	(picnic areas)	181						
hiking	(trail miles)	0						
nature study	(trail miles)	1						
swimming	(water acres)	14						
shore fishing	(shoreline feet)	160,000						
boating	(boat ramp lanes)	63						
boating *	(water acres)	16,600						
* includes boat fishing								
PEAK DAY NET FACILITY REQUIREMENTS								
	facility units	1990	2001	2010	2020	2030	2040	2060
camping	(campsites)	380	664	834	898	746	762	816
picnicking	(picnic areas)	226	307	347	375	401	420	436
hiking	(trail miles)	2	2	2	2	3	3	3
nature study	(trail miles)	9	12	13	13	14	14	16
swimming	(water acres)	0	0	0	0	0	1	1
shore fishing	(shoreline feet)	0	0	0	0	0	0	0
boating	(boat ramp lanes)	14	29	37	43	47	60	63
boating *	(water acres)	0	0	0	0	0	0	0
* includes boat fishing								

Table 19.
Projected Activity-Days, Gross Facility Requirements,
Existing Facilities, and Net Facility Requirements,
Caddo Lake

PROJECTED ACTMTYDAYS								
	% dist.	1990	2001	2010	2020	2030	2040	2050
camping	18.81%	99,800	116,000	124,900	131,900	137,500	141,800	145,500
picnicking	4.27%	25,300	29,400	31,700	33,600	34,900	38,000	38,900
hiking	2.28%	13,400	16,800	18,800	17,700	18,600	19,000	19,500
nature study	1.26%	7,400	8,800	9,300	9,800	10,300	10,800	10,900
swimming	13.93%	82,500	98,000	103,400	109,300	113,900	117,400	120,600
shore fishing	14.22%	84,200	98,000	105,600	111,800	118,300	119,900	123,000
boat fishing	28.44%	188,400	198,000	211,200	223,200	232,900	239,800	248,100
boating	18.82%	111,600	129,700	139,800	147,700	163,900	168,700	162,900
TOTAL		602,200	889,200	742,700	784,700	817,900	843,100	866,300

PEAK DAY GROSS FACILITY REQUIREMENTS

	facility units	1990	2001	2010	2020	2030	2040	2060
camping	(campsites)	591	884	741	783	818	842	884
picnicking	(picnic areas)	88	100	108	114	119	122	126
hiking	(trail miles)	2	3	3	3	3	3	4
nature study	(trail miles)	2	3	3	3	3	3	3
swimming	(water acres)	2	2	2	3	3	3	3
shore fishing	(shoreline feet)	18,719	19,469	20,988	22,180	23,093	23,808	24,423
boat fishing	(water acres)	268	298	321	339	363	384	374
boating	(boat ramp lanes)	31	38	39	41	43	44	48
boating *	(water acres)	1,737	2,020	2,177	2,300	2,397	2,472	2,637

EXISTING FACILITIES (units)

	facility units	
camping	(campsites)	122
picnicking	(picnic areas)	130
hiking	(trail miles)	0
nature study	(trail miles)	0
swimming	(water acres)	0
shore fishing	(shoreline feet)	0
boating	(boat ramp lanes)	28
boating *	(water acres)	25,400

* includes boat fishing

PEAK DAY NET FACILITY REQUIREMENTS

	facility units	1990	2001	2010	2020	2030	2040	2060
camping	(campsites)	489	682	619	881	894	720	742
picnicking	(picnic areas)	0	0	0	0	0	0	0
hiking	(trail miles)	2	3	3	3	3	3	4
nature study	(trail miles)	2	3	3	3	3	3	3
swimming	(water acres)	2	2	2	3	3	3	3
shore fishing	(shoreline feet)	18,719	18,460	20,988	22,180	23,003	23,808	24,423
boating	(boat ramp lanes)	3	8	11	13	16	16	18
boating *	(water acres)	0	0	0	0	0	0	0

* includes boat fishing

The trail head would mark the end of the recreational development plan for the state of Louisiana. In Texas, recreational amenities would be provided at Caddo Lake State Park and terminate at Lake O' The Pines. Caddo Lake State Park presently meets some of the region's recreational needs, however, the existing facilities do not satisfy the demands placed on the park. The Texas Parks and Wildlife Department has acquired an additional 600 acres across State Highway 43 to help remedy this condition. Having secured this land, an excellent opportunity exists for the U.S. Army Corps of Engineers and the State of Texas to share the cost of its development. Enough land is available to provide multi-use campsites (400 recreation vehicle sites and 171 tent camping sites), eight boat ramps, a staging area for equestrian use, and a starting point for both equestrian and hike/bike trails.

The equestrian trail would proceed towards Jefferson along the southern edge of the navigation channel, while the hike/bike trail would cross over the bridge at State Highway 43 and continue along the northern edge. A stopping point midway between Caddo Lake State Park and Jefferson would be provided along the equestrian trail. This area would serve as a resting point and have a source of potable water and picnic tables. Located approximately six miles east of Jefferson, along the hike/bike trail, 2,000 linear feet of shoreline fishing are being proposed. This location was selected for two reasons: first, it is in close proximity to Jefferson and, secondly, existing roadways already lead to this locale. Although road improvements will be needed, a county right of way is already in place.

Jefferson is served by several major roadways, including U.S. Highway 59, State Highway 49 and Farm Road 134. The area presently caters to a growing tourist population. Jefferson is well known for its historically significant structures and long-standing relationship with Big Cypress Bayou and Caddo Lake. A boat tour company and canoe rental establishment are presently located near downtown Jefferson. There is also a horse riding stable, which fulfills another type of recreational demand. It would be feasible to provide a staging area for equestrian trail use at this location.

These three businesses (boat tour, canoe rental and riding stable) have already demonstrated that there is a need for these services. The point at which State Highway 49 and U.S. Highway 59 intersect Big Cypress Bayou is very active and could easily support concessionaires. Downstream from proposed Lock and Dam 7, along the eastern boundary of Jefferson, a boat tour concessionaire could be established. A canoe rental business could be located upstream from Lock and Dam 7, sheltered along the section of Big Cypress Bayou running parallel to the southern edge of Jefferson.

On their respective sides of the navigation channel, the equestrian and hike/bike trails would continue in a westerly direction towards Lake O' The Pines. Halfway between Jefferson and Lake O' The Pines, a resting point along the equestrian trail would be capable of providing picnic tables and a source of potable water. Directly across from this area, on the other side of Big Cypress Bayou, a tent campsite and canoe launching area has been proposed. The campsite would provide hikers and bicyclists with an overnight resting point. The canoe launching

ramp would serve as a water access point. People would then paddle downstream to Jefferson, concluding a seven mile journey.

The hike/bike trail would terminate at Ferrell's Bridge Dam. Access to the trail head would be provided from a parking lot off Highway 726. This parking area would also accommodate vehicles belonging to individuals using the five hundred foot shoreline fishing area located on the spillway side of the dam. An equestrian staging area would be located on the other side of Big Cypress Bayou, across from the shoreline fishing zone.

On the northwest side of Ferrell's Bridge Dam is Lake O' The Pines. The facilities identified in the needs and demands analysis coincide with the figures formerly included in the U.S. Army Corps of Engineers' Master Plan for Lake O' The Pines. Proposed facilities included as part of the present project were added to areas that had previously been identified for future development. Recreation vehicle facilities (200), picnic tables (100), and three boat lanes are being proposed for the land across from Johnson Creek Park. Additional camping facilities will be provided south of Brushy Creek Park (75 recreation vehicle sites, 55 tent sites and 147 picnic tables), and along the shoreline south of the Willow Point area (125 recreation vehicles, 75 tent sites, 60 picnic tables, and 6 boat ramps). Twenty additional boat ramp locations have been identified and will be constructed as the needs present themselves..

ESTIMATED ANNUAL VISITATION

Recreation visitor-days associated with the new recreation facilities were estimated by reversing the process used to convert baseline visitor-days into facilities requirements, as described above. Since the facilities were sized for the net demand in the project base year, it could be assumed that they would be used to capacity immediately upon installation. The load factors associated with each kind of facility were therefore used to determine the peak day visitation that would be supported, which was divided by the ratio of peak day use to annual use for that recreation activity to get annual visitor-days. Also, a net facilities requirement for picnic areas, over and above that based on surveyed existing visitation, was added to account for the demand for them created by new users of the multi-purpose and equestrian trails.

RECREATION BENEFIT-COST ANALYSIS

Benefits.

The statistical visitor-day relationships for Lake O' The Pines and Caddo Lake were used to generate second-stage demand curves for recreation at each site, based on visitors' demonstrated propensity to incur time and travel costs to visit them. Taking each county's actual travel distance as a baseline, the distance was increased by an arbitrary amount and its total participation rate and visitor-days recomputed using the new distance. This process was repeated until the recomputed visitor-days fell to zero or the new distance exceeded the original

distance of the most distant county. Summing over counties for each increment of distance gave total visitor-days as a function of travel distance, which translated into travel cost (cost of time and vehicular cost).

Tables 20 and 21 display this computation for Lake O' The Pines and Caddo Lake, and Figures 8 and 9 show the second-stage demand curves graphically. Integrating the area under the demand curves yielded the total consumer surplus (the annual economic benefit) associated with existing recreation – \$11.4 million, divided almost equally between Lake O' The Pines and Caddo Lake. Dividing the total annual benefit by the number of baseline visitor-days gave the average annual benefit per visitor-day at each site: \$4.58 for Lake O' The Pines, and \$9.68 for Caddo Lake. The substantially higher value for Caddo Lake again reflects its distinctive physical, aesthetic, and recreational qualities, which make it a more powerful attractor for visitors from distant locations. These values were assumed to remain constant throughout the period of analysis, and to apply to all recreation activities.

Since the proposed additional recreation facilities were scaled to the net facilities requirements projected for the project base year of 2001, it was assumed that they would be used to capacity in that year and throughout the study period. The annual economic benefit associated with the additional recreation facilities would therefore be constant over time. It is equal to the additional annual visitor-days that the facilities would support multiplied by the average benefit per visitor-day already modeled for each site. Proposed facilities for Big Cypress Bayou and Twelve Mile Bayou were assigned to Lake O' The Pines or Caddo Lake for purpose of this calculation, as stated above.

Tables 22, 23, and 24 summarize the proposed additional facilities, additional activity-days supported, and economic benefits for Lake O' The Pines, Caddo Lake, and the total study area. The resulting annual recreation benefit, as of the project base year of 2001, is \$4,471,000 at November 1992 price levels.

Costs.

Table 25 displays the preliminary estimated cost of the recreation facilities proposed for the project area. The total first cost would be \$43,195,000 at November 1992 price levels. The total investment cost would be \$44,993,000. This assumes that individual sites could be constructed in one year on the average, with mid-year expenditures of funds, for purposes of computing interest during construction. The corresponding average annual cost would be \$3,940,000 (amortized over 50 years at 8.5 percent, and including \$50,000 for annual operations and maintenance).

Benefit-Cost Ratio.

Based on the preliminary analyses described above, the benefit-cost ratio of recreation facilities associated with the proposed navigation project would be 1.1,

Table 20.
Computation of Economic Benefit
per Visitor-Day,
Lake O' The Pines

Estimated Visitor Occasions at Incremental Distance	One-Way Incremental Distance (miles)	Wtd. Avg. Time Cost of Travel per Person •	Vehicle Cost per Person • *	Incremental Total cost per Person	Average Total Cost [1]	Diff. in Visitors [2]	Consumer Surplus [1] x [2]
1,254,109	0	\$0.00	\$0.00	\$0.00			
755,157	5	\$0.60	\$0.77	\$1.36	\$0.68	498,952	\$339,921
496,026	10	\$1.19	\$1.53	\$2.73	\$2.04	259,131	\$529,616
347,732	15	\$1.79	\$2.30	\$4.09	\$3.41	148,294	\$505,143
256,354	20	\$2.39	\$3.06	\$5.45	\$4.77	91,378	\$435,771
196,669	25	\$2.98	\$3.83	\$6.81	\$6.13	59,685	\$365,952
155,804	30	\$3.58	\$4.59	\$8.18	\$7.49	40,865	\$306,242
126,720	35	\$4.18	\$5.36	\$9.54	\$8.86	29,084	\$257,582
105,337	40	\$4.78	\$6.13	\$10.90	\$10.22	21,384	\$218,520
89,175	45	\$5.37	\$6.89	\$12.26	\$11.58	16,161	\$187,174
76,588	50	\$5.97	\$7.66	\$13.63	\$12.94	12,587	\$162,932
58,770	60	\$7.16	\$9.19	\$16.35	\$14.99	17,818	\$267,058
46,862	70	\$8.36	\$10.72	\$19.08	\$17.71	11,908	\$210,927
38,495	80	\$9.55	\$12.25	\$21.80	\$20.44	8,367	\$171,002
32,311	so	\$10.74	\$13.78	\$24.53	\$23.16	6,184	\$143,249
27,701	100	\$11.94	\$15.31	\$27.25	\$25.89	4,610	\$119,353
20,012	125	\$14.92	\$19.14	\$34.06	\$30.66	7,688	\$235,702
15,362	150	\$17.91	\$22.97	\$40.88	\$37.47	4,650	\$174,228
12,283	175	\$20.89	\$26.80	\$47.69	\$44.28	3,080	\$136,380
10,111	200	\$23.88	\$30.63	\$54.50	\$51.10	2,172	\$110,969
8,500	225	\$26.86	\$34.45	\$61.31	\$57.91	1,611	\$93,300
7,274	250	\$29.85	\$38.28	\$68.13	\$64.72	1,225	\$79,294
6,302	275	\$32.83	\$42.11	\$74.94	\$71.53	972	\$69,541
5,214	300	\$35.82	\$45.94	\$81.75	\$78.35	1,089	\$85,291
4,601	325	\$38.80	\$49.77	\$88.57	\$85.16	612	\$52,136
2,881	350	\$41.78	\$53.59	\$95.38	\$91.97	1,720	\$158,210
2,518	375	\$44.77	\$57.42	\$102.19	\$98.78	363	\$35,886
1,795	400	\$47.75	\$61.25	\$109.00	\$105.60	723	\$76,295
809	425	\$50.74	\$65.08	\$115.82	\$112.41	986	\$110,871
675	450	\$53.72	\$68.91	\$122.63	\$119.22	134	\$16,022
521	475	\$56.71	\$72.73	\$129.44	\$126.04	153	\$19,343
219	500	\$59.69	\$76.56	\$136.25	\$132.85	303	\$40,212
115	525	\$62.68	\$80.39	\$143.07	\$139.66	104	\$14,510
0	550	\$65.66	\$84.22	\$149.88	\$146.47	115	\$16,802

Consumer Surplus: \$5,745,434

Average Consumer Surplus per Baseline Visitor Occasion: \$4.58

- State of Texas average earnings per hour in June 1992 was \$ 11.02 (Texas Labor Market Review, Texas Employment Commission, July 1992). Travel time valued at 1/3 of average earnings per hour for adults, 1 /12 of average earnings per hour for children (U.S. Water Resources Council, 1979). Assumes 3.2 persons per vehicle: 2.4 adults (74%) and 0.8 children (26%) (based on 1990 statewide ratio of population over 16 years of age to total population). Assumes average vehicle speed of 50 miles per hour.
- * Assumes \$0.245 per mile and 3.2 persons per vehicle (see above).

Figure 8.
Second-Stage Demand Curve
Lake O' The Pines

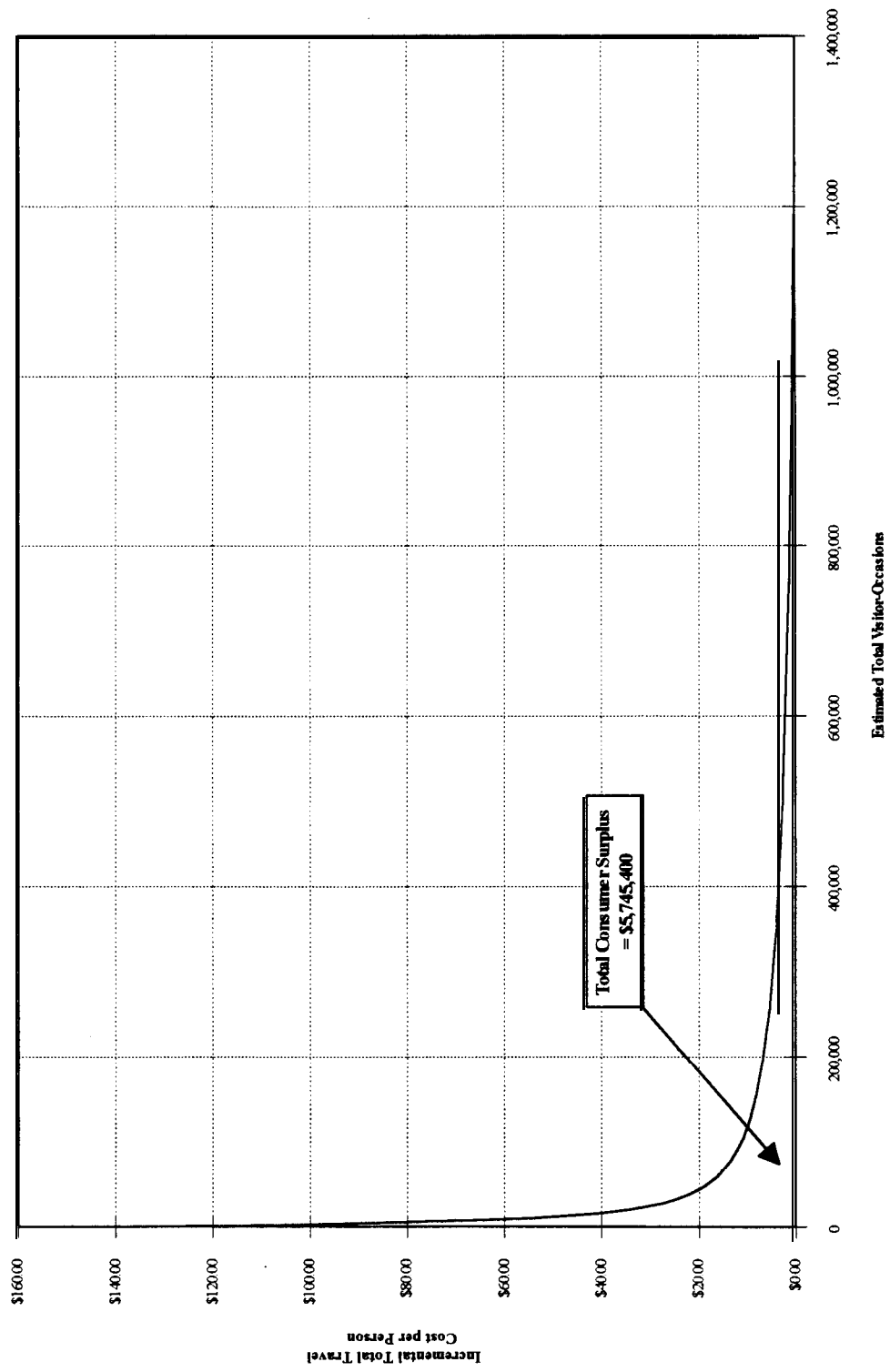


Table 21.
Computation of Economic Benefit
per Visitor-Day,
Caddo Lake

Estimated Visitor Occasions at Incremental Distance	One-Way Incremental Distance (miles)	Wtd. Avg. Time Cost of Travel per Person*	Vehicle cost per Person *	Incremental Total Cost per Person	Average Total cost [1]	Diff. in Visitors [2]	Consumer Surplus [1] x [2]
592,187	0	\$0.00	\$0.00	\$0.00			
418,326	5	\$0.60	\$0.77	\$1.36	\$0.68	173,861	\$118,446
320,254	10	\$1.19	\$1.53	\$2.73	\$2.04	98,071	\$200,439
257,627	15	\$1.79	\$2.30	\$4.09	\$3.41	62,627	\$213,331
214,358	20	\$2.39	\$3.06	\$5.45	\$4.77	43,269	\$206,345
182,788	25	\$2.98	\$3.83	\$6.81	\$6.13	31,570	\$193,569
158,804	30	\$3.58	\$4.59	\$8.18	\$7.49	23,984	\$179,735
140,017	35	\$4.18	\$5.36	\$9.54	\$8.86	18,787	\$166,389
124,929	40	\$4.78	\$6.13	\$10.90	\$10.22	15,088	\$154,187
112,564	45	\$5.37	\$6.89	\$12.26	\$11.58	12,365	\$143,210
102,062	50	\$5.97	\$7.66	\$13.63	\$12.94	10,502	\$135,942
85,771	60	\$7.16	\$9.19	\$16.35	\$14.99	16,290	\$244,156
73,695	70	\$8.36	\$10.72	\$19.08	\$17.71	12,076	\$213,907
64,210	80	\$9.55	\$12.25	\$21.80	\$20.44	9,485	\$193,865
56,544	90	\$10.74	\$13.78	\$24.53	\$23.16	7,666	\$177,571
50,498	100	\$11.94	\$15.31	\$27.25	\$25.89	6,046	\$156,517
39,405	125	\$14.92	\$19.14	\$34.06	\$30.66	11,093	\$340,078
31,887	150	\$17.91	\$22.97	\$40.88	\$37.47	7,518	\$281,689
26,484	175	\$20.89	\$26.80	\$47.69	\$44.28	5,403	\$239,264
22,434	200	\$23.88	\$30.63	\$54.50	\$51.10	4,050	\$206,956
19,281	225	\$26.86	\$34.45	\$61.31	\$57.91	3,153	\$182,588
16,796	250	\$29.85	\$38.28	\$68.13	\$64.72	2,485	\$160,801
14,560	275	\$32.83	\$42.11	\$74.94	\$71.53	2,236	\$159,917
12,372	300	\$35.82	\$45.94	\$81.75	\$78.35	2,189	\$171,483
11,028	325	\$38.80	\$49.77	\$88.57	\$85.16	1,344	\$114,458
7,022	350	\$41.78	\$53.59	\$95.38	\$91.97	4,006	\$368,437
6,080	375	\$44.77	\$57.42	\$102.19	\$98.78	942	\$93,026
4,269	400	\$47.75	\$61.25	\$109.00	\$105.60	1,811	\$191,193
1,978	425	\$50.74	\$65.08	\$115.82	\$112.41	2,291	\$257,576
1,668	450	\$53.72	\$68.91	\$122.63	\$119.22	310	\$36,955
1,276	475	\$56.71	\$72.73	\$129.44	\$126.04	392	\$49,380
967	500	\$59.69	\$76.56	\$136.25	\$132.85	310	\$41,135
627	525	\$62.68	\$80.39	\$143.07	\$139.66	339	\$47,368
72	550	\$65.66	\$84.22	\$149.88	\$146.47	555	\$81,360
0	575	\$68.65	\$88.05	\$156.69	\$153.29	72	\$11,018

Consumer Surplus: \$5,732,291

Average Consumer Surplus per Baseline Visitor Occasion: \$9.68

- State of Texas average earnings per hour in June 1992 was \$ 11.02 (Texas Labor Market Review, Texas Employment Commission, July 1992). Travel time valued at 1/3 of average earnings per hour for adults, 1 /12 of average earnings per hour for children (U.S. Water Resources Council, 1979). Assumes 3.2 persons per vehicle: 2.4 adults (74%) and 0.8 children (26%) (based on 1990 statewide ratio of population over 16 years of age to total population). Assumes average vehicle speed of 50 miles per hour.
- * Assumes \$0.245 per mile and 3.2 persons per vehicle (see above).

**Figure 9.
Second-Stage Demand Curve
Caddo Lake**

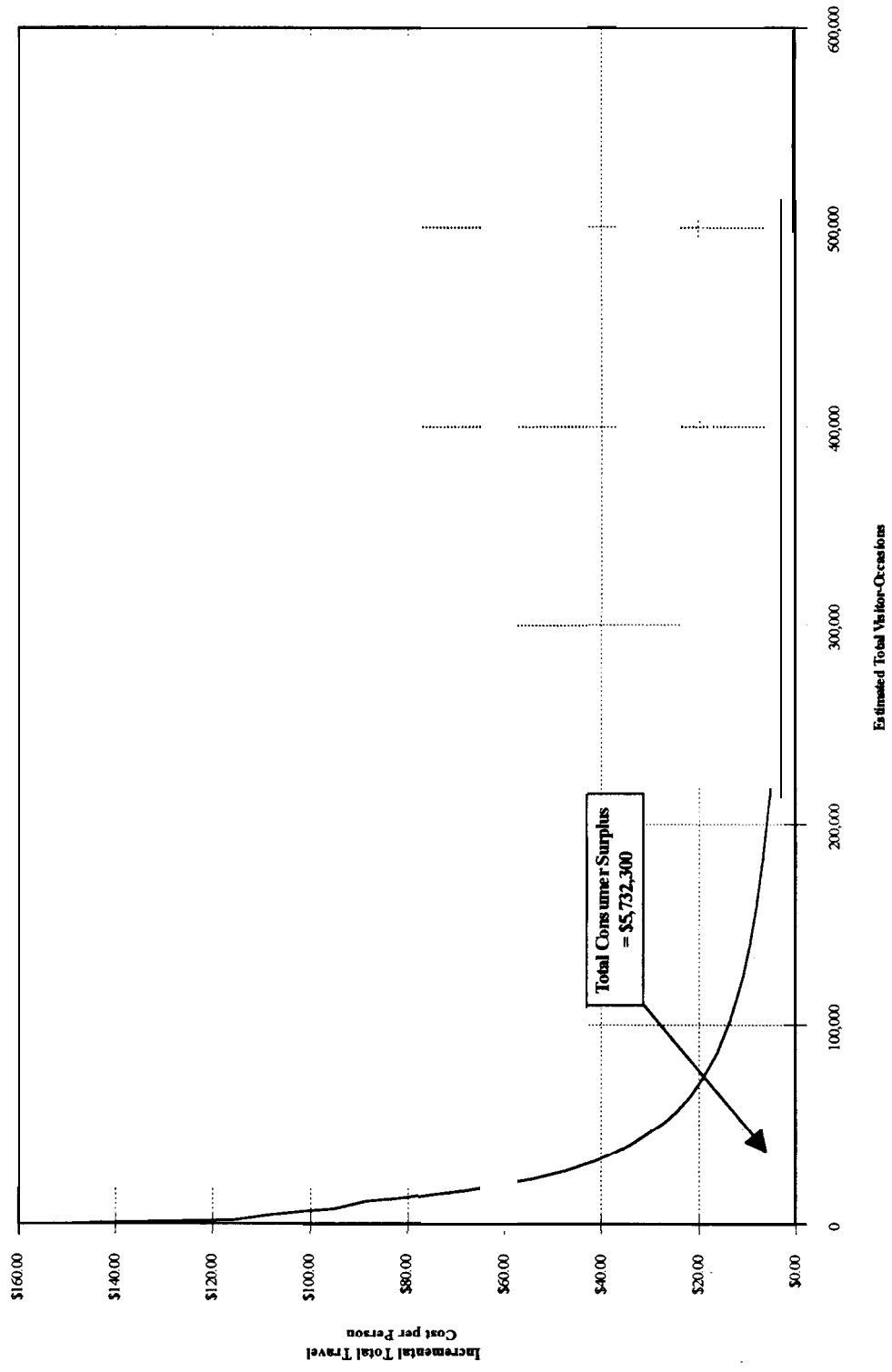


Table 22.
Proposed Additional Facilities, Additional
Activity-Days, and Economic Benefits,
Lake O' The Pines

PROPOSED ADDITIONAL FACILITIES

	facility units:	1990	2001	2010	2020	2030	2040	2050
camping	(campsites)	n/a	664	664	664	664	664	664
picnicking *	(picnic areas)	n/a	349	349	349	349	349	349
multi-use trail	(trail miles)	n/a	13	13	13	13	13	13
nature study	(trail miles)	n/a	0	0	0	0	0	0
swimming	(water acres)	n/a	0	0	0	0	0	0
shore fishing	(shoreline feet)	n/a	0	0	0	0	0	0
boating	(boat ramp lanes)	n/a	29	29	29	29	29	29
boating *	(water acres)	n/a	0	0	0	0	0	0
equestrian trail	(trail miles)	n/a	13	13	13	13	13	13

- includes additional demand associated with multi-use and equestrian trail visitors
- * includes boat fishing

ADDITIONAL ACTIVITY-DAYS SUPPORTED

	facility units:	1990	2001	2010	2020	2030	2040	2060
camping	(campsites)	n/a	93,349	93,348	93,348	93,348	93,349	93,348
picnicking *	(picnic areas)	n/a	102,667	102,667	102,667	102,667	102,667	102,667
multi-use trail	(trail miles)	n/a	70,897	70,897	70,697	70,697	70,697	70,697
nature study	(trail miles)	n/a	0	0	0	0	0	0
swimming	(water acres)	n/a	0	0	0	0	0	0
shore fishing	(shoreline feet)	n/a	0	0	0	0	0	0
boating	(boat ramp lanes)	n/a	103,447	103,447	103,447	103,447	103,447	103,447
boating *	(water acres)	n/a	0	0	0	0	0	0
equestrian trail	(trail miles)	n/a	14,906	14,906	14,906	14,906	14,906	14,906
TOTAL			370,349	370,349	370,349	370,349	370,349	370,349

- includes additional demand associated with multi-use and equestrian trail visitors
- ** includes boat fishing

BENEFITS

	facility units:	1990	2001	2010	2020	2030	2040	2060
camping	(campsites)	n/a	\$427,662	\$427,662	\$427,662	\$427,662	\$427,662	\$427,662
picnicking *	(picnic areas)	n/a	\$470,302	\$470,302	\$470,302	\$470,302	\$470,302	\$470,302
multi-use trail	(trail miles)	n/a	\$324,801	\$324,901	\$324,601	\$324,901	\$324,901	\$324,601
nature study	(trail miles)	n/a	\$0	\$0	\$0	\$0	\$0	\$0
swimming	(water acres)	n/a	\$0	\$0	\$0	\$0	\$0	\$0
shore fishing	(shoreline feet)	n/a	\$0	\$0	\$0	\$0	\$0	\$0
boating	(boat ramp lanes)	n/a	\$473,922	\$473,922	\$473,922	\$473,922	\$473,922	\$473,922
boating *	(water acres)	n/a	\$0	\$0	\$0	\$0	\$0	\$0
equestrian trail	(trail miles)	n/a	\$68,286	\$68,286	\$68,286	\$68,286	\$68,286	\$68,286
TOTAL			\$1,764,962	\$1,764,962	\$1,764,962	\$1,764,962	\$1,764,962	\$1,764,962

- includes additional demand associated with multi-use and equestrian trail visitors
- ** includes boat fishing

Table 23.
Proposed Additional Facilities, Additional
Activity-Days, and Economic Benefits,
Caddo Lake

PROPOSED ADDITIONAL FACILITIES

	facility units	1990	2001	2010	2020	2030	2040	2060
camping	(campsites)	n/a	662	662	662	662	662	662
picnicking *	(picnic areas)	n/a	7s	7s	7s	7s	7s	7s
multi-use trail	(trail miles)	n/a	26	26	26	26	26	26
nature study	(trail miles)	n/a	0	0	0	0	0	0
swimming	(water acres)	n/a	0	0	0	0	0	0
shore fishing	(shoreline feet)	n/a	4,000	4,000	4,000	4,000	4,000	4,000
boating	(boat ramp lanes)	n/a	8	8	8	8	8	8
boating *	(water acres)	n/a	0	0	0	0	0	0
equestrian trail	(trail miles)	n/a	13	13	13	13	13	13

* includes additional demand associated with multi-use and equestrian trail visitors
 ** includes boat fishing

ADDITIONAL ACTIVITY-DAYS SUPPORT60

	facility units	1990	2001	2010	2020	2030	2040	2060
camping	(campsites)	n/a	95,249	94,696	94,696	94,696	94,696	94,696
picnicking *	(picnic areas)	n/a	23,079	23,079	23,079	23,079	23,079	23,079
multi-use trail	(trail miles)	n/a	136,341	136,341	136,341	136,341	136,341	136,341
nature study	(trail miles)	n/a	0	0	0	0	0	0
swimming	(water acres)	n/a	0	0	0	0	0	0
shore fishing	(shoreline feet)	n/a	20,146	20,146	20,146	20,146	20,146	20,146
boating	(boat ramp lanes)	n/a	6,269	6,269	6,269	6,269	6,269	6,269
boating *	(water acres)	n/a	0	0	0	0	0	0
equestrian trail	(trail miles)	n/a	14,905	14,006	14,906	14,905	14,906	14,905
TOTAL			260,063	278,628	279,629	279,629	279,629	279,529

* includes additional demand associated with multi-use and equestrian trail visitors
 ** includes boat fishing

BENEFITS

	facility units	1990	2001	2010	2020	2030	2040	2060
camping	(campsites)	n/a	\$922,002	\$918,640	\$918,640	\$918,640	\$918,640	\$918,640
picnicking *	(picnic areas)	n/a	\$223,401	\$223,401	\$223,401	\$223,401	\$223,401	\$223,401
multi-use trail	(trail miles)	n/a	\$1,319,765	\$1,319,765	\$1,319,765	\$1,319,765	\$1,319,765	\$1,319,765
nature study	(trail miles)	n/a	\$0	\$0	\$0	\$0	\$0	\$0
swimming	(water acres)	n/a	\$0	\$0	\$0	\$0	\$0	\$0
shore fishing	(shoreline feet)	n/a	\$194,999	\$194,999	\$194,999	\$194,999	\$194,999	\$194,999
boating	(boat ramp lanes)	n/a	\$61,002	\$61,002	\$61,002	\$61,002	\$61,002	\$61,002
boating *	(water acres)	n/a	\$0	\$0	\$0	\$0	\$0	\$0
equestrian trail	(trail miles)	n/a	\$144,280	\$144,260	\$144,260	\$144,260	\$144,260	\$144,280
TOTAL			\$2,711,169	\$2,705,807	\$2,705,807	\$2,705,807	\$2,705,807	\$2,705,807

* includes additional demand associated with multi-use and equestrian trail visitors
 ** includes boat fishing

Table 24.
Proposed Additional Facilities, Additional
Activity-Days, and Economic Benefits,
Total Study Area

PROPOSED ADDITIONAL FACILITIES

	facility units	1990	2001	2010	2020	2030	2040	2060
camping	(campsites)	n/a	1,118	1,118	1,118	1,118	1,118	1,118
picnicking *	(picnic • easl	n/a	427	427	427	427	427	427
multi-use trail	(trail miles)	n/a	38	38	38	38	38	38
nature • tudy	(trail milal	n/a	0	0	0	0	0	0
swimming	(water acres)	n/a	0	0	0	0	0	0
shore fishing	(shoreline feet)	n/a	4,000	4,000	4,000	4,000	4,000	4,000
boating	(boat ramp lanes)	n/a	37	37	37	37	37	37
boating • *	(water acres)	n/a	0	0	0	0	0	0
equestrian trail	(trail miles)	n/a	28	28	28	28	28	28

* includes additional demand associated with multi-use • nd equestrian trail visitors
 • * includes boat fishing

ADDITIONAL ACTIVITY-DAYS SUPPORTED

	facility units	1990	2001	2010	2020	2030	2040	2060
camping	(campsites)	n/a	188,043	188,043	188,043	188,043	188,043	188,043
picnicking •	(picnic • r-l	n/a	126,738	126,738	126,738	126,738	126,738	126,738
multi-use trail	(trail milal	n/a	207,239	207,239	207,239	207,239	207,239	207,239
nature study	(trail milal	n/a	0	0	0	0	0	0
swimming	(water acres)	n/a	0	0	0	0	0	0
shore fishing	(shoreline feet)	n/a	20,146	20,146	20,146	20,146	20,146	20,146
boating	(boat ramp lanes)	n/a	108,718	108,718	108,718	108,718	108,718	108,718
boating • •	(water acres)	n/a	0	0	0	0	0	0
equestrian trail	(trail milal	n/a	29,810	29,810	29,810	29,810	29,810	29,810
TOTAL			049,879	849,879	849,879	849,879	849,879	849,879

* includes additional demand associated with multi-use • nd equestrian trail visitors
 **includes boat fishing

BENEFITS

	facility units	1990	2001	2010	2020	2030	2040	2080
camping	(campsites)	n/a	\$1,344,292	\$1,344,292	\$1,344,292	\$1,344,292	\$1,344,292	\$1,344,292
picnicking •	(picnic • areas)	n/a	\$803,703	\$893,703	\$893,703	\$803,703	\$893,703	\$893,703
multi-use trail	(trail miles)	n/a	\$1,644,566	\$1,644,566	\$1,644,566	\$1,644,566	\$1,644,566	\$1,644,566
nature study	(trail miles)	n/a	t o	\$0	\$0	\$0	\$0	\$0
swimming	(water acres)	n/a	\$0	\$0	t o	\$0	\$0	\$0
shore fishing	(shoreline feet)	n/a	\$194,999	\$1 94,999	\$194,999	\$194,999	\$194,999	\$194,999
boating	(boat ramp lanes)	n/a	\$624,024	\$624,924	\$624,924	\$624,924	\$624,924	1624,924
boating • *	(water acres)	n/a	\$0	\$0	\$0	\$0	\$0	\$0
equestrian trail	(trail miles)	n/a	1212,686	\$212,686	\$212,686	\$212,686	\$212,686	\$212,686
TOTAL			\$4,470,769	\$4,470,769	\$4,470,769	\$4,470,769	\$4,470,769	\$4,470,769

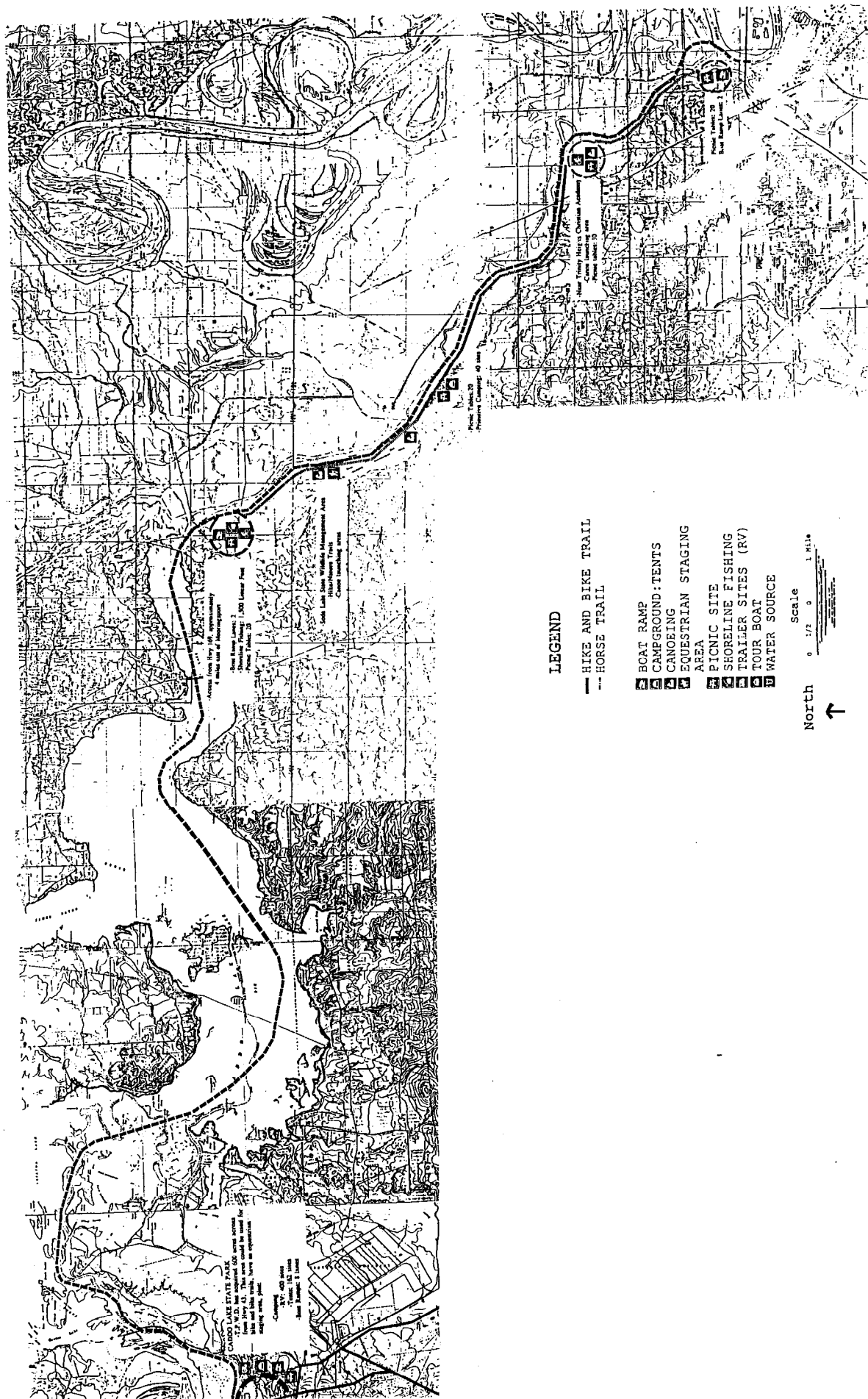
* includes additional demand associated with multi-use and equestrian trail visitors
 • * includes boat fishing

Table 25.
Preliminary Cost Estimate
for Recreation Development

item	quantity	unit	unit price	total
Hike & Bike Trails	200,640	lf	\$17.03	\$3,416,899
Equestrian Trails	137,280	lf	\$5.68	\$779,750
Pedestrian Bridges	11,100	lf	\$170.31	\$1,890,441
Picnic Sites <i>(table, concrete pad, grill, grading, seeding)</i>	427	site	\$5,676.84	\$2,424,011
Camping: tent	316	site	\$1,135.37	\$358,777
multi-use <i>(including access roads)</i>	800	site	\$17,371.12	\$13,896,896
Composting Toilets	14	toilet	\$17,030.51	\$238,427
Waterborne Toilets	23	toilet	\$13,536.70	\$2,611,344
Canoe Ramps	6	lane	\$90,829.36	\$544,976
Boat Ramps	37	lane	\$90,829.36	\$3,360,686
Courtesy-Docks	13	dock	\$12,489.04	\$162,358
Fishing Pier	1	pier	\$170,305.05	\$170,305
Vehicle Parking	1,876	space	\$851.53	\$1,597,470
Roadways <i>(6" HMA, 18,000 LF x 24'-0")</i>	432,000	sf	\$1.33	\$574,560
Lime Stabilization	112	ton	\$238.43	\$26,704
Subtotal				\$32,053,605
Contingencies <i>(20%)</i>				\$6,410,721
Subtotal				\$38,464,326
Engrg. & Design <i>(6%)</i>				\$2,307,860
Supv. & Admin. <i>(6.3%)</i>				\$2,423,253
Total				\$43,195,438
			USE:	\$43,195,000

Table 25.
Preliminary Cost Estimate
for Recreation Development

item	quantity	unit	unit price	total
Hike & Bike Trails	200,640	lf	\$17.03	\$3,416,899
Equestrian Trails	137,280	lf	\$5.68	\$779,750
Pedestrian Bridges	11,100	lf	\$170.31	\$1,890,441
Picnic Sites <i>(table, concrete pad, grill, grading, seeding)</i>	427	site	\$5,676.84	\$2,424,011
Camping: tent	316	site	\$1,135.37	\$358,777
multi-use <i>(including access roads)</i>	800	site	\$17,371.12	\$13,896,896
Composting Toilets	14	toilet	\$17,030.51	\$238,427
Waterborne Toilets	23	toilet	\$113,536.70	\$2,611,344
Canoe Ramps	6	lane	\$90,829.36	\$544,976
Boat Ramps	37	lane	\$90,829.36	\$3,360,686
Courtesy Docks	13	dock	\$12,489.04	\$162,358
Fishing Pier		pier	\$170,305.05	\$170,305
Vehicle Parking	1,876	space	\$851.53	\$1,597,470
Roadways <i>(6" HMA, 18,000 LF x 24'-0")</i>	432,000	sf	\$1.33	\$574,560
Lime Stabilization	112	ton	\$238.43	\$26,704
Subtotal				\$32,053,605
Contingencies <i>(20%)</i>				\$6,410,721
Subtotal				\$38,464,326
Engrg. & Design <i>(6%)</i>				\$2,307,860
Supv. & Admin. <i>(6.3%)</i>				\$2,423,253
Total				\$43,195,438
			USE:	\$43,195,000



SHEET 2: Caddo Lake, TX and portion of Big Cypress Bayou, TX

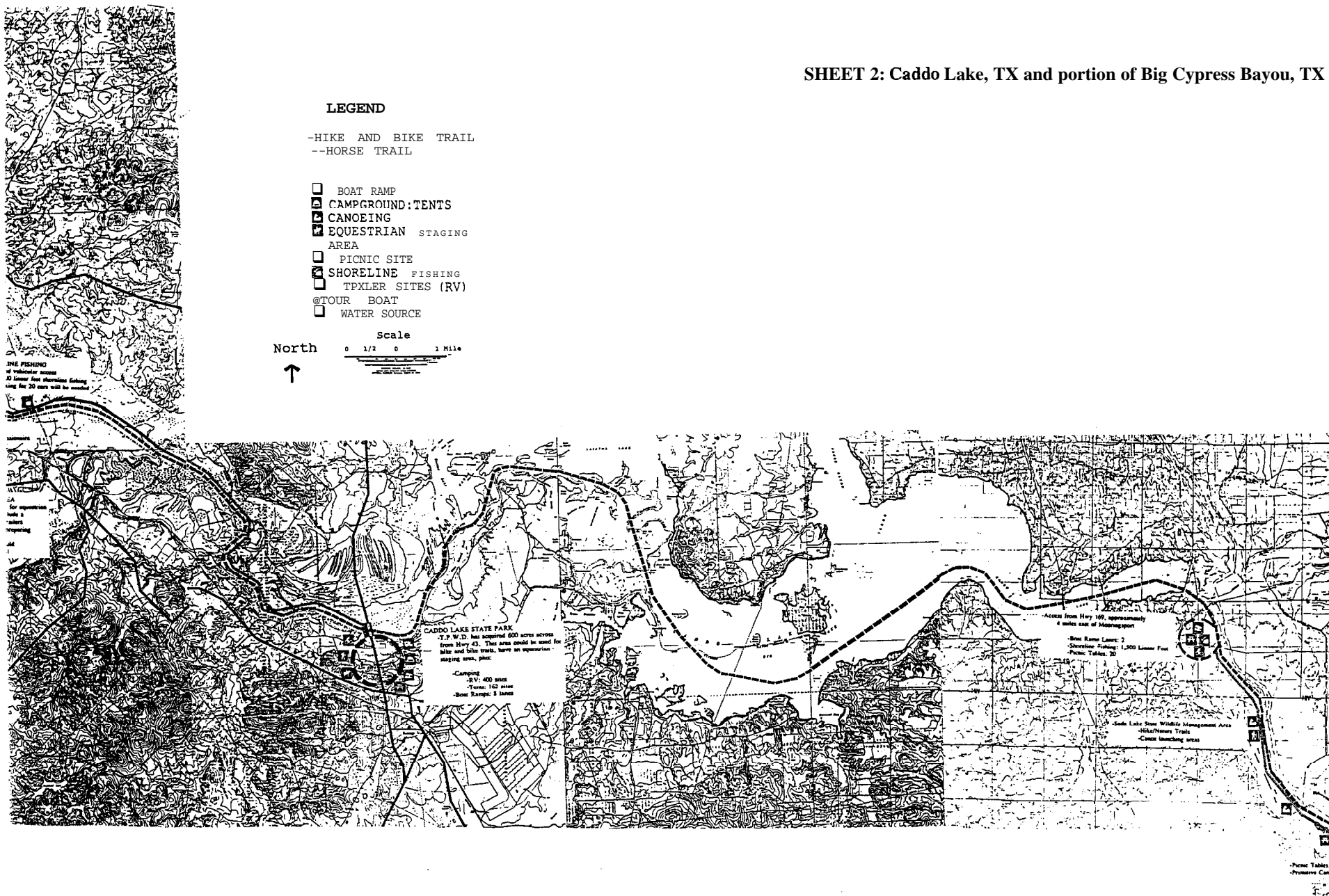
LEGEND

-HIKE AND BIKE TRAIL
--HORSE TRAIL

- BOAT RAMP
- CAMPGROUND: TENTS
- CANOEING
- EQUESTRIAN STAGING AREA
- PICNIC SITE
- SHORELINE FISHING
- TPXLR SITES (RV)
- @TOUR BOAT
- WATER SOURCE

North
↑

Scale
0 1/2 0 1 Mile



SHEET 3: Texas- Portion of Big Cypress Bayou, Jefferson and Lake o' the Pines

